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A JOURNEY ACROSS TIBET, FROM NORTH TO SOUTH, AND WEST TO LADAK.*

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We left England on November 10, 1894, the same party as usual:—Mrs. Littledale, myself, and our dog, accompanied in addition by my nephew, Mr. W. A. L. Fletcher, of Oxford University boating renown, who proved himself to be in every respect an admirable travelling companion. My scheme was to strain every nerve to reach Tibet, and, if possible, Lhasa, with plenty of food and animals to carry it. Most of the other expeditions had failed owing to their arriving in a more or less destitute condition, and then, of course, the Tibetans could dictate their own terms. We also relied upon bribery, and went well prepared with the sinews of war for wholesale corruption.

Travelling by Constantinople and Tiflis, we reached Samarkand just as the winter set in. Encased in several thicknesses of fur, we drove to Osh. The cold was so intense that one day five out of the six post-boys at Uratiube were sent to the hospital badly frost-bitten, and our tarantass one night broke through the ice into a river, and was instantly frozen fast. At Osh Colonel Grombchefsky had ordered yurts, firewood, etc., to be ready for us at every march across the Tian Shan, and, thanks to his excellent arrangements, we crossed the Terek pass (12,700 feet) in midwinter without any material discomfort. I may take this opportunity of saying that, as on previous occasions, nothing could possibly exceed the kindness shown to us by all and every Russian official with whom we were thrown in contact. Our guns, stores, and baggage were passed through the customs unopened; Count Rostofftsoff, governor of Samarkand, had ordered a

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special carriage for us on the train, and sent men to Osh to look out for our heavy baggage.

We arrived in Kashgar on January 5, 1895, and remained for some time under Mr. Macartney's hospitable roof, which was our last taste of the comforts of civilization until the middle of November, when Captain Trench, the deputy-commissioner, kindly received us in his charming house at Srinagar. We found four Ladakis, who had been sent from Leh, waiting for us; but four Pathans we were also expecting had not turned up. We were loath to go without them, as we had been counting on them to stand by us in the case of a scrimmage. The Ladakis, though excellent men in their way, would be of doubtful value in a situation of that kind. We waited there ten days for them, and just as we were starting for Yarkand they joined us. They had had fearful weather on the Karakoram, and three out of the four had their feet frost-bitten. A British native hospital assistant travelled with them, and this wretched man had never attempted to wash or dress their wounds, which were in consequence more serious than they need have been. The Chinese in Turkistan are a very under-sized, effeminate, and degraded race. In passing through the bazaars, a man was overheard to say, "These barbarians, after all, have some men among them." I presume Mr. Fletcher's 6 feet 3 inches called forth the remark.

The Taotai of Kashgar informed us that it was quite true the Japanese had taken Port Arthur, but that afterwards the Chinese had turned them out. An official, who had drilled and armed some 200 men European fashion, once asked the Taotai of Urumtsi to review them. He simply turned his back upon them, and said, "What can they do, compared with the brave soldiers with whom I reconquered this province." We were kindly invited to a Chinese dinner by some official. First there came eight dishes of sweets, cut in small pieces, and rather prettily arranged; then followed sharks' fins, sea-slugs, bamboo shoots, and numberless greasy dishes. Among the guests was Dr. Sven Hedin, who added considerably to the merriment of the party.

The road from Kashgar to Yarkand, about 120 miles, was very uninteresting, ankle-deep in dust. We had some grand views of the Mustagh-Ata and the Gez defile. Every poti (approximately 3 miles) there were square towers about 20 feet high, with crenelated tops, serving the double purpose of watch-towers and milestones. Like everything else in China, they were falling to pieces. Their locations had been chosen more with a view of saving cost by having either stones or bricks handy, than with any regard to the distances they were supposed to measure. At Yarkand we were located in a house which would have been charming in summer, but which was quite unsuited to the arctic weather which we then had. With the help of the British aksakal we commenced to buy our caravan, and

we very soon found that not only were prices materially higher than at Kurla, but the stamp of animal was inferior. After the caravan season is over, horses are tied up in sheds all winter, and their hoofs consequently grow to an abnormal length. The hoof is so tough that the English process of paring them down would be too tedious. The horse is made to stand on a block of wood, and with a chisel and a few blows of a heavy hammer the hoof is shortened. We abandoned all idea of taking camels on discovering that, even travelling empty, they would in all probability be foot-sore, and require a long rest at Cherchen; so we decided to substitute mules and donkeys. While we were buying some mules there was a desperate fight between an onlooker and a Chinese mule-owner, the onlooker trying to persuade the other man to sell. It is a curious custom that you cannot buy the merest trifle in the streets without an "honest" broker turning up, who acts as mediator, and the seller has to be entreated, even threatened, by his friend, to induce him to sell, which he does eventually with apparently the greatest reluctance. Not having been able to procure any rupees or Indian currency notes in London before starting, we purchased all that were offered us. The pilgrims, who formerly used to pass through Russian Turkistan, now, for some reason or other, seem to prefer going to Mekka *viâ* India, and as they absorb a large amount of Indian currency, the price of rupees was very high.

Considering the extremely difficult nature of the country that lies between Rawal Pindi, the railway shipping point, and Yarkand, a distance of over 500 miles, in the course of which no less than five high passes have to be surmounted, and a large extent of barren country to be crossed, it says a good deal for the enterprise and energy of the merchants, that there should be any interchange of commodities between India and Central Asia by the Karakoram route, and it is therefore doubly satisfactory to find that during the last year there has been a large increase of trade. This is, no doubt, partially owing to the opening of a cart-road from Kashmir to the plains of India, the popularity of which road is proved by the long string of carts and other vehicles which are incessantly passing up and down. Great as was the cost in the first instance of making the road down the valley of the Jhelum, and large as are the sums that have yearly to be spent in repairs, there is little doubt that it will prove indirectly a most remunerative investment for the Kashmir Durbar. A capital caravan-track has also been made from Srinagar to the Ladak frontier, to the excellence of which we can personally testify.

On leaving Yarkand, February 4, the weather became warmer; the greater part of the way was deep sand, and the horses must have been very tough to drag the carts through it. On the road we were overtaken by the frost-bitten men, who had been left behind in Kashgar to be doctored by the Russian hospital assistant, thanks to the kindness

of M. Petrovski, who, as on our previous journey, proved himself to be a true friend. Two were doing well, but the havildar's foot was not in at all a satisfactory condition. We had to become doctors and hospital nurses in addition to our multifarious duties.

Both in Yarkand and Khotan goitre is very prevalent. We noticed that the enlargement is usually on the right side of the neck, though sometimes on both, and it generally forms two distinct lumps like cricket-balls, one below the other; the natives say it is never fatal. Theoretically, the Chinese monetary system is very convenient: 10 fen = 1 miscal, and 10 miscal = 1 seer; but, unfortunately, all payments are made in tengahs, sixteen of which go to a seer in Kashgar, and only eight in Khotan, so confusion results. We made every effort to buy old manuscripts. We went to visit a native who I was told privately had one. He was a very deep old gentleman, and professed not to understand what was wanted, and eventually we had to leave without even seeing it. The manuscript, could we have got hold of it, ought to have proved interesting. A native, who had seen it, said that it was written on antelope skin in ancient characters, and that it described all the treasures that had been hidden in the neighbourhood ages ago.

Khotan has been celebrated for its jade for upwards of two thousand years, and the manufactory of the raw stone into bangles, amulets, etc., is still carried on, though there is no work now done here that will bear comparison with the fine jade carving in China. We were offered some ornaments that at first blush we took for fine specimens of jade, but which on examination proved to be glass. We detected the imposition in time, and were thus more fortunate than a distinguished Russian traveller, who bought a magnificent jade vase with the intention of presenting it to the late emperor. In his case, the fraud was not discovered till the vase arrived in St. Petersburg to have a suitable case made for it.

During our stay at Khotan we were very busy buying and branding horses, mules, and donkeys, and laying in large supplies of everything that we could not buy in Cherchen; milk and cream being plentiful, we churned in bottles a good deal of butter, which we salted and soldered up in tins. Our mules cost us from £6 to £10 apiece, the ponies about £4, and the donkeys about £1; Indian corn a farthing a pound. The houses here have no windows, only a hole in the roof. After a few days, the feeling of being boxed-in becomes very depressing. Our men captured a couple of thieves on the roof of a house, and they were well thrashed. We have given out that the next lot will be thrashed first, and then handed over to the tender mercy of the Amban.

From Khotan we went to Keria in carts, passing on the way a good deal of desert. Beyond Keria it was said to be impossible to take our carts, so we paid them off and hired horses and donkeys to Cherchen,

our own animals going nearly empty to save them. From Keria to Cherchen there are two roads. The more southerly follows close along the foot of the mountains, and there is said to be good grass and water most of the way. The northern road, which we followed, goes nearly straight, and is several days shorter; both grass and water are scarce and bad. This road is only used in winter, it being almost impassable in the summer owing to the flies and want of water. Occasionally we would come to small streams, which, descending from the mountains to the south of us, would run north and lose themselves in the sand of the Takla Makan. The Amban at Keria told us that formerly he heard that

BOAT LADEN WITH BAGGAGE ON THE SACHU CHU.

people used to cross the desert to Kuchar, but now nobody ever attempted it or knew the road.

A kind of broom grows very plentifully on the top of steep-sided mounds, sometimes 15 and 18 feet high; the mounds appear to be raised either by the dust collecting in the branches of the plant, when the buried portion of the branches strike new lateral roots and the top puts out new shoots, or by the roots preventing the light pulverized soil from being blown away, or by both these causes combined. In crossing sandhills, I noticed that wherever the sand was in small undulations like the waves of a pond, it was fairly solid, but when the sand had a smooth surface, the horses usually sank in deeply. The windward side of a sandhill was never at so steep an angle as the lee side; I accounted for it in the following manner. Each grain of sand is half protected by the grain below it from the wind, so that it stays there; other grains of sand

are blown over the top one and roll down the lee side till a platform is made large enough for a fresh grain to rest on the summit, half showing above the one below it; and so the mound goes on getting higher and higher till a shift of wind comes which blows the top of the hill away, and the former lee side, now the windward one, is at a sufficiently gentle angle to allow the wind to roll the grains of sand uphill, and so the process goes on.

The natives tell the most marvellous stories of the gold and precious stones that they dig up from the ruins of the cities buried by the sand. They make regular expeditions into the desert to recover lost treasures, and many of them had strange tales about old fortified cities which were guarded by ancient men in quaint Chinese costumes, speaking an unknown tongue. The only water-supply of a small village between Keria and Nia was a well 120 feet deep; the hauling of water must be a severe tax on the inhabitants, as it is all done by hand. The whole of our caravan had to be watered there, as we had the next day a long march of 35 or 40 miles to Nia, the nearest drinking-place. Here we hired some more horses to go to Cherchen for the reasonable sum of 6*s*. 8*d*. a horse, a ten or twelve days' journey with no chance of a return hire. We sent on four men, who were to keep ahead of us and deepen the wells along the road, which are rarely more than 6 feet deep, and are constantly filling up with drifting sand. The large number of animals we had then with us required a good deal of water. At one camp we found the water in the wells quite undrinkable; none of the animals even would touch it, so we determined to dig a fresh well for ourselves. The donkey with tools not having come in, the Ladakis set to work with their bare hands, and they had got down 4 feet before the caravan arrived. A couple of feet deeper we found plenty of good water. In old wells the saltness of the water is due to continual evaporation of the water, while the salt that is in the water does not evaporate; consequently the water and the neighbouring soil becomes gradually more and more impregnated with salt. Precisely the same thing goes on in every lake that has no outlet. We afterwards discovered that wherever chi grass grows, there is always water within 5 or 6 feet of the surface. Between Nia and Cherchen there were hardly any inhabitants, only a few shepherds here and there. Occasionally we would pass forests of poplar and stretches of chi grass, but the bulk of the country was dry sand, and whenever we climbed an elevation we could always see, stretching away to the northern horizon, mound after mound and ridge beyond ridge of the moistureless shifting sand of which the horrible desert of the Taklamakan consists.

On March 19 we reached Cherchen. There is no town proper, but the houses are dotted here and there amidst irrigation fields; we did not see a single Chinaman, all the inhabitants apparently being Turkis.

We were informed that the mountain range called the Tokus Dawan would be impassable for three months. Being incredulous, we sent off a couple of our own men to see, and while they were gone we purchased supplies largely. We were lucky enough to hit off one of the only two bazaars that are held annually in the place. The people who came to the fair made extremely convenient temporary hammocks for their babies out of men's coats, which were slung by the arms from tree to tree, the little things remaining in them quite contentedly while their parents attended to their business. We had some tent-pegs made here for fivepence apiece. How they can sell them for the money I

NEAR THE GORING LA.

cannot conceive. All the iron comes from Yarkand, and it must reach there either from India or Russia, an immense distance in either case. As an instance of how rapidly vegetation comes on with the warm weather, on April 5 the apricot trees only showed faint indications of buds; two days later they were shedding their blossoms. We ran short of change, so we followed the custom of the country and sent some of our big lumps of silver to the blacksmith, who, under careful surveillance, cut them up into little bits. We took with us 25,000 lbs. of Indian corn for our animals, and six months' provision for ourselves and men. Our caravan consisted of 250 animals, but of these, 130 or 140 were hired with the understanding that they were to return on reaching the south side of the Akka-Tagh. The caravan people to a man declared that they had never been so far south as the Akka-Tagh—a statement which we much doubted. Through the dilatoriness of the natives, we could not start before April 12. We had in our employ a Ladaki who accompanied

Monsieur Dutreuil de Rhins, and had been somewhere in this district; but he accounted for his utter want of knowledge of the country by the statement that when he was here before he was snow-blind. He strained his back soon after leaving Cherchen, and we sent him down from the mountains with some hired horses. We soon left all cultivation behind, and marched up the Cherchen river through a barren sandy country to the Tokus Dawan. Leaving the river, we twisted and turned up narrow valleys having steep clay hills on either hand, with at first little or no grazing, but sufficient bortza for fuel. Some days after we rejoined the rapid muddy Cherchen river flowing through a deep valley, bounded on the south by the snow-clad Tokus Dawan. In one place the rocks descended steeply into the river, but by making a road we were able to lead our animals over safely one by one. The following day we tried to ford the river, but, finding it impossible, marched along its banks for a couple of days before we could cross, thus wasting three or four days before we could make further progress south. After crossing, we turned down stream again, and eventually camped in a valley where there was good grazing and water.

At our next camp grass was very scarce, and there was no water. Soon after we came to the Cherchen river for the third time. It here flowed through a marsh, which was fortunately frozen through solid, with the exception of the main channel, that had cut through the ice, leaving perpendicular sides 4 or 5 feet high. After finding a ford, we had to hack with axes an inclined path to the level of the water on each side of the river to enable the animals to descend. Our caravan was so large that it took some hours getting it across. The first detachment got over easily; but later, as the sun got power, big sheets of ice came tearing down stream. A sharp look-out had to be kept to avoid disaster. While I was on horseback in mid-stream, helping a man who was trying to save one of our animals which was being carried down the stream, a piece of ice struck my pony behind, and we were carried down 50 yards before I could get clear; the animal, fortunately for me, kept his legs, for the water was bitterly cold. We marched up a broad plain, the snowy Akka-Tagh being still to the south, and we here saw our first Tibet antelope (*Pantholops Hodgsonii*) and kyang (*Equus hemionus*). As we went on both game and grass grew scarcer, and at our camp there was next to none. Here a deputation of our drivers came asking permission to go back with their animals, pleading the want of grass. We put them off with fair words, and plodded on some days through utter barrenness.

On April 28, in bitter weather and snowing hard, we crossed a pass. There was little or no vegetation, and the Ladakis said they felt the breathing more than on the Karakoram. Soon after crossing we found slight vegetation, but as we went on that ceased, and we had to camp in a plain where there was absolutely nothing for our animals to eat.

Ahead of us, as far as we could see, there were high mountains. Having no guide, we took the most likely looking valley, and it ended in our camping near the summit of a pass in intense cold, where there was neither grass nor fuel. Having brought for an occasion like this some tins of Silver's self-boiling soup, personally we did pretty well. There was plenty of ice, but no fuel, so we could not melt it, and had a dry camp. A valuable horse died here. As he was travelling empty, I suppose the great elevation was the cause. The next day things looked very black; there were no signs during our march of either grass or fuel till evening, when the valley suddenly opened out, and to our

A TYPICAL TIBETAN VALLEY.

great relief on the other side of a broad plain we saw water and grass, and in the distance a frozen lake. To the south hills appeared, low, and, as the lake had no apparent outlet, we imagined we were over the Akka-Tagh and on the Tibet plateau. Two of our men who I sent on to see the country ahead reported it all right, so we paid off our hirelings with the exception of some donkeys, which their owners agreed to take a week's journey further. I very soon found that we were not over the Akka-Tagh at all, and that our men, who were supposed to have crossed the hills to the south, had deceived us, and had never done so; so, taking a Ladaki with me, I made several efforts to find a suitable pass over the mountains. On climbing a ridge to the south, instead of finding myself, as I hoped, on the edge of the Tibetan plateau, I saw in front seven extinct volcanoes; three were small, but four of them

were grand fellows. They stood quite apart, and were unconnected either with themselves or with the Akka-Tagh, which lay further south. The summits of the volcanoes were so covered with masses of snow and ice that it was not possible to see their craters; and between us and the Akka-Tagh lay such a rough, barren country, that we decided to spare our animals and look elsewhere for a passage. It took us ten days before we discovered a pass and collected our animals, which had been dispersed by a heavy snowstorm.

We crossed the Akka-Tagh on May 15. The pass, though not steep, was high and long, and it cost us the lives of five or six donkeys and a couple of horses. We found ourselves at last on the Tibetan plateau, having lakes and low mountains to the south, as far as could be seen, and to the north we had the high range of the Akka-Tagh, with fine glaciers and snowfields. By angles taken from several different points, I measured two peaks close together, which towered above their neighbours, and I made them out to be 25,340 feet. This great upshoot of the Earth's surface, which from its enormous elevation and size deserves, in its central part, far more than the Pamirs the name "Roof of the World," may be considered to commence in the west with the Pamirs, where, however, its physical character differs in some parts considerably from the central or Tibetan portion, which again bears little resemblance to its eastern continuation on the confines of China. On the Pamirs we find a high mountainous country. Where the rivers are fairly large and rapid, the valleys are precipitous; in other parts, where the streams are unimportant, the country is more undulating in character, and the lakes are, with some notable exceptions, fresh. The Tibetan plateau proper, which probably has an average height quite 2000 feet in excess of the Pamirs, has, in its northern part especially, a very small rainfall, and in the absence of rivers the drainage of the country finds its way into one or other of the innumerable lakes, which, having no outlet, are salt. Except in the volcanic country, the valleys are broad and open. The eastern end, however, is the cradle of numerous large rivers which discharge their waters into the Indian Ocean and China Sea, and which in the course of ages have worn deep channels, and entirely changed the character of the country. Nearly the whole of this large district lies above timber-line, and it would, I imagine, be possible to travel from the Pamirs to within a short distance of China proper, about 30 degrees of longitude, without ever seeing a tree or shrub higher than an umbrella.

We purchased here the pick of our hired animals, and the others went back, thus severing our last link with the outer world. Our party consisted of our three selves and ten men, thirteen in all, an unlucky number; but we decided to get over the difficulty by counting in our terrier, which had much more sense than some members of the party. A Turki who had agreed to come with us, and who as an inducement had

received a good many months' wages in advance, here evidently intended to bolt back to Cherchen, and as we were terribly short-handed we took the liberty of decorating him for a few nights with a pair of handcuffs. He afterwards proved to be quite one of our best men.

We passed through a volcanic country with little grass, and water rather scarce. Later in the summer the grass would be better, but in May there was only the previous year's growth, which had had all its nutriment weathered out of it, and our animals began to suffer severely. Owing to the scarcity of fodder they wandered a great deal, and we had constantly either to make a very late start or stay a day while the missing

A TIBETAN GROUP IN THE GORING TANGU VALLEY.

animals were found. Antelope were fairly numerous, and in some cases absurdly tame. One old buck followed alongside me, gradually edging nearer and nearer till he was within 40 yards; he then trotted round in front and stopped till he got our wind, and then went off. He evidently had never seen a white man before. We were on a part of the Chang where there was no trace of human beings, and no reason why there should be any. Water was very scarce. We frequently found a small spring or patch of snow sufficient for our party, but the animals had to make many dry camps. One morning our flock of nineteen sheep were missing, and it turned out that the men through carelessness had not tied them up the previous night, and the wolves had killed every one, giving them each a bite on the throat and leaving them. We now had to rely entirely on our rifles for food. Owing to the high altitude, scarcity of food, and

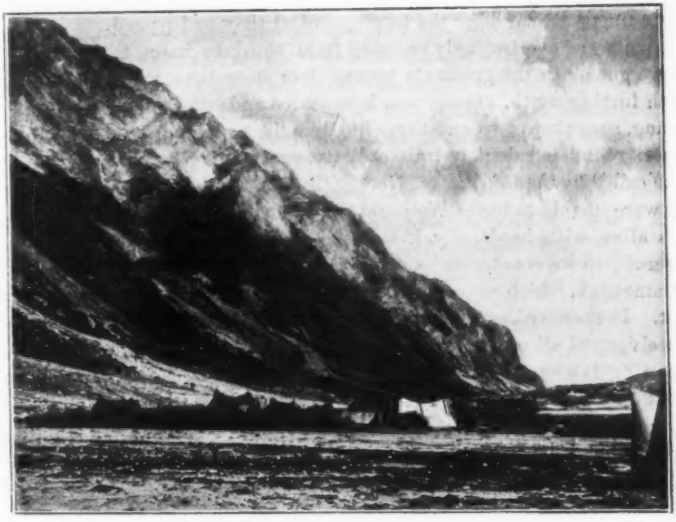
cold, our animals began to die off at an appalling rate, and my nephew and I had to give up our riding-ponies to carry the stores. Having to walk made our work rather severe, as, in addition to packing and repacking our animals, going ahead to find the road for the morrow, we had also to make a special tramp for our dinner, unless we had had the good luck to shoot some game during our march. The mountains ahead looking very uninviting, the caravan bashi and I started off for a couple of days to see if we could find a road over them. In the distance we saw a high volcanic-looking hill, to the top of which we struggled, and had a capital bird's-eye view of the country. We had seen for some time previously what looked like a continuous high snowy range stretching east and west right across our course, and how we were to get over it had been the cause of much anxiety, but I was relieved to find that what had appeared from down below to be one range was really an unconnected succession of short ridges and peaks; in fact, after we left the Akka-Tagh we never saw a single continuous mountain range till we came to the Ninchen-Tangla, south of the Tengri-Nor.

On returning to camp, I found that, although stationary, our animals were dying in an ominous way, and the survivors were so weak that when they fell or lay down, we had to lift them on to their legs again. We had utilized every scrap of felt we possessed to make extra clothing and hoods for our donkeys, but all to no purpose; the mortality was terrible. After making one more march, we decided that everything that could possibly be spared must be abandoned, clothes, camp furniture, and natural history specimens, horse shoes, even the very bindings of books which were essential, were ruthlessly abandoned. Our men, seeing new clothes thus thrown away, wished to exchange their own rags for them; we told them they might take what they liked, but if any one took a coat, for instance, he must leave his own in exchange. It was, perhaps, a little difficult to arrange an exact equivalent for some ladies' garments. A very fine yak's head was among the condemned articles, and it was a source of almost secret satisfaction to find, a couple of days afterwards, that it had been carried on by mistake. The following day, however, things became still more critical, and it had to go with the rest.

We travelled on for some time with a dwindling stud over a succession of passes of no great height above the general run of the country, but many of them were steep, and all trying for our weak, exhausted caravan. Not a day passed but several animals had to be shot or abandoned. It is a gruesome subject which I will not further pursue. We passed three very conspicuous volcanoes, which must have been considerably over 20,000 feet. They had made excellent landmarks for some time previously. Between 36° 50′ and 33° 50′ N. lat., our path lay through a very volcanic region, numerous undoubted volcanoes being visible. South of 33° 50′ I did not notice any, till three months later we passed the conspicuous volcano Tongo. We struggled on, and just as

things were getting desperate we found some excellent grazing, and we stayed for a week to fatten up our animals. The weather became milder, and those beasts which were not too far gone regained strength rapidly; the poor animals ate incessantly from morning to night.

June 26, lat. 33° 12′ N., and long. 88° 12′ E., was remarkable for two things: we had the first rain since leaving the Black Sea in November—and I think at this point we first came under the influence of the south-west monsoon; the skies became more cloudy as we went south, and we frequently had small showers—and we saw the first men since Cherchen, in the middle of April. These men were Tibetans, and



LAMAS' ENCAMPMENT WITH PILES OF FIREWOOD.

had large flocks of sheep and herds of yak, and they were collecting large piles of salt from the lake near their camp for the monasteries of Lhasa. We kept sentries over our horses all night and day, and we watched their camp carefully to see if we had been discovered or if they moved. We examined the ground, and decided it would be impossible to get over the large plain on which they were encamped without being seen unless we made a night march, so at sunset we started. We had not gone far before we stuck in a swamp, and there was every prospect of our having to remain there all night and being discovered in the morning, but we managed to struggle through just as the moon set, and, marching all night, we camped at dawn in a secluded valley across the plain. We always went on ahead of the caravan, and looked carefully over the ground with our telescopes, and whenever we saw any

encampments we used to try and avoid them by changing our route, and if that was impossible, then by making night marches. Just at one critical time, when passing at night close to an encampment, the donkey carrying our pet cock and hen chose to tumble, and there was a great cackling and fuss; then a mule trod on our Turki dog, who gave a piteous howl. I found a luminous match-box a great assistance in reading the prismatic compass during the night marches when a lantern was impossible. One small herd of yak, which was right in our track, caused us great anxiety, but it turned out afterwards that they were wild ones. We were making very short marches, camping each day as soon as we got good grazing, and doing everything in our power to get our animals strong after the terrible ordeal they had passed.

We were everlastingly crossing from one lake basin to another, but as we got south the gradients became less steep than what we had met with further north. Game was here scarce and wild, but large herds of kyang, sometimes two and three hundred in a drove, would gallop and wheel round our donkey train. We passed along the east side of the lake called by Captain Bower Garing Cho, into which runs a river, which we were unable to ford. We could not go further east, because the plain was alive with herds of yak and sheep, and we should have been discovered; so we constructed a sort of boat, using our camp beds to make a framework, which we covered with the waterproof ground-sheet of our tent. It answered capitally, and with a rope from side to side we ferried ourselves and all our stores over dry. Our animals swam across. The following day we found the plain deserted; the herds had all been driven about 10 miles to the south. At first we were afraid we had been discovered, as one of our mules had strayed close to a Tibetan camp. Finding it impossible to get past unseen to the west, we turned more to the east. Seen from a distance, the shores of the Pongok Tso appeared to be piled up with ice-floes, but on getting closer we found the white appearance was due to salt. The grazing in this district was of the most luxurious description, and our animals were now in capital condition. There were so many encampments about, that we were liable to be discovered at any moment. We stopped within a mile and a half of one encampment, but by keeping our animals in a ravine till dusk, and letting them feed at night, we were unnoticed. At last we came to a valley in which we counted thirty tents; thinking it quite useless to attempt any further concealment, we decided to go straight through them. We kept up on the hills till the last moment, and then went between the encampments, and to our amazement got through undiscovered. They took us for a trading party. We had made our natives keep the caravan bunched together; Mrs. Littledale, Mr. Fletcher, and I, having removed our hats, kept out of sight amongst the baggage animals. We waited till dusk before we dared pitch our tents, for they would have instantly betrayed us. The following day, however, we had to pass up a narrow ravine in which

there were some shepherds. The men, on seeing us, pluckily bolted up the mountains, leaving their wives in charge; then the murder was out, and they came and asked us to stop till they could communicate with their headmen. They appeared to be a very good-natured lot of people, and were very friendly, laughing and talking with our men. It was palpable that the common people bear strangers no ill will, and that all the trouble springs from Lhasa.

We now entirely changed our tactics, and pushed on as hard as we could, and, our animals being in good condition and having very light loads, we travelled very fast. We calculated that we could reach Lhasa in eight forced marches, and we had kept sixteen donkey-loads of grain through all our troubles for this occasion, so our animals got a feed of corn night and morning. The local officials came and entreated us to stop, informing us that they would all be executed if they allowed us to pass; and as we travelled, bands of men, armed with matchlocks, and with swords stuck through their belts, kept on either side of us, and every morning some official would try entreaties and threats. Our object was to push on so fast that they would not have time to collect their militia in sufficient numbers to stop us. Having no guides, we were often at a loss as to the best road to take, but on one occasion this helped us considerably. Turning one evening up a valley, we camped, but not liking the look on ahead, we retraced our steps early next morning. That move completely upset the plans of the Tibetans; they had evidently thought we were going that way, and the bulk of the men had gone on ahead, and we made the next day's march unmolested. On approaching difficult ground the Tibetans would always stop behind, and leave us to flounder amongst the rocks or swamps, and whenever any of them stated that there was no road in a certain direction we knew we were not wanted to go that way, so when in doubt we always did the opposite to what they advised. We crossed a low pass, and then came in sight of the Tengri-Nor, locally known by the name of Nam-Tso = Great Sky Lake, vividly blue, stretching away far to the east, with here and there a small island. A number of promontories jutted into the lake from the north, while on the south it was fringed by the magnificent range of the Ninchen-Tangla;—a succession of snow-clad peaks and glaciers, partially hidden in clouds and vapour, which added to their size and grandeur, while above all towered with cliffs of appalling steepness the great peak of Charemaru, 24,153 feet. From this point of view it was, perhaps, one of the most impressive mountains I had ever seen; but as we went further south, and changed our point of view, we found that it was not a needle-shaped rock piercing the sky, but a sharp ridge, having a peak at either end. In the Lama survey map of Tibet, published 1733, there is a mountain marked Chimuran, in very much the same position as Charemaru; the similarity of the names can hardly be accidental. We passed within a few

miles of the monastery Dorkia Lagu Dong, but an intervening hill prevented our seeing it.

As we approached the Ninchen Tangla, we were very much perplexed as to how we were to cross that mass of snow and ice, and another obstacle in a deep rapid river appeared. We wasted a couple of hours in finding a ford, which was a bad one at the best. Here the Tibetans came up in a body and announced that they would not allow us on any terms to cross the river, and on advancing, a determined picturesque-looking individual seized my bridle; I whipped out my revolver, and he immediately let go. We forded the river, watched by the party with scowling looks. We had not the faintest notion up which valley, if any, the pass was, and men whom we sent out over the plain to find a track returned without information. One Ladaki, however, who had been sent to watch a man who we thought was going with a letter to the Deva Jung, and from whose movements we hoped to get an inkling of the Lhasa road, announced that he had seen some laden yak, which must, he thought, have come down one of two valleys; so we headed the caravan in that direction on the chance, and camped in the dark in pelting rain, everybody quite tired out; for since we had been discovered we had not only to march all day, but keep guard over our animals all night. At midnight we sent our two most reliable men to see if they could find a road. One, on returning, said the grass in a valley was all eaten short, and he thought it might be the right valley; so we started next morning.

None of the Tibetans were now to be seen, which made us rather uneasy, for it proved one of two things: either we were on the wrong road, or they had gone on ahead to hold some strong position. The latter was the case. We found them occupying both sides of a narrow ravine, lying down behind stones, with only rows and rows of black heads visible. As we approached, some six or eight men came out to meet us, and they said they would shoot if we advanced. I pulled out my Chinese passport, and said it was given by a greater man than any at Lhasa. But it was all to no purpose; give us leave to advance they would not. So I told our men to load their rifles. The three sepoys had Colt's lightning-repeaters—and very handy weapons they were; Mr. Fletcher and three other men had expresses, etc.; I a Mannlicher; and the rest of the party had theodolite and camera-legs put into spare gun-covers, and they made a brave show. Mrs. Littledale was very indignant with me because I would not let her have a rifle, and insisted on her keeping back among the baggage-animals. I turned round to see which of our men were going to back us up, and there were the three Pathans, nursing their rifles, looking at me with murder in their eyes, impatiently awaiting the signal to begin. If any nation is counting on our Indian soldiers not proving to be fully a match for any troops they may be sent against, I can assure them they are making a grievous

mistake. Here were these men, who had been through the Kabul war and knew what fighting meant, ready to face hopeless odds simply because their sahib ordered them. They did not know what we did, that our opponents were such utter cowards that the odds were very much against their having the pluck to fight at all. Our bluff succeeded; the matches of their guns were extinguished, they did not fire, and we passed unharmed. A Tibetan headman said afterwards to one of the Ladakis, "These foreigners must be a great people." He replied, "Of course they are; when they go to Pekin they are always honoured guests of the Emperor of China!" We pushed on up the pass, which formed a water-parting between the Tibetan plateau and the country drained by the Brahmaputra river. We found by keeping to the rocks we avoided the glacier, which was much crevassed.

We reached the summit of the Goring La (19,587 feet) about 4 p.m. We waited some hours for our animals to come up, but the donkeys were not able to get over that night; so, leaving a guard with them, we started down the glacier, as night was coming on, in a snowstorm which covered up all tracks, and we had to grope our way, avoiding crevasses by sounding each step with an alpenstock—a far more dangerous business than facing any number of Tibetan matchlockmen. On camping we found that every scrap of food was with our donkeys, and so all idea of a rush for Lhasa had to be abandoned. When they arrived they were all so played out we stopped a day. A Tibetan swell came with about a hundred men: he was such a comical, roundabout, jovial-looking man. While talking he gesticulated and grimaced to an extraordinary degree. He wore a broad-brimmed hat carefully covered with green oil silk. On the principle of not cheapening ourselves, we professed to be dissatisfied with his rank, told him that we would neither stop nor discuss our plans with any little man, and pushed on. He kept repeating, "Kuch, kuch," with his thumbs up in the air, and making signs with his hand across his throat. The numbers opposing us increased rapidly, and at last I thought it prudent to ask the headman if he would really lose his head if we advanced. He replied, "Undoubtedly." So I told him that, though his rank was beneath our contempt, still, as he seemed a decent sort of fellow, we would stop for his sake. He informed us that he would probably be fined a rupee for every footprint our horses had made this side of the pass. The latitude of this camp was 30° 12′ 12″ N. The natives said they ordinarily took two marches, but, with a good horse, could go to Lhasa in a day. He asked if it was true that there was a big tree near Calcutta, out of the branches of which came all the heat of India; and whether our telescopes enabled us to see right through the mountains.

The next day three more Lamas arrived. They professed great pleasure at seeing us, but wished to know why we had undertaken such a journey. They were told we had come to make our salaams to the Dalai Lama.

Things did not progress. They asked if we would not go back, and they would not allow us to go forward, what did I think would happen? I answered by another question, What did they think would happen when the news reached India that we, bearing Chinese and English passports, had been shot while passing peaceably through their country? They hurriedly said there would be no fighting. Our negotiations went on for about a week; we at last declined to discuss further the question of returning, and all stood up in our tent to show the interview was at an end. Daily letters were all this time passing between them and Lhasa. We were left alone for some days, and amused ourselves by catching butterflies and making botanical collections. Wishing to keep on good terms with the Lamas, we did no shooting, as of course it is contrary to their tenets to take life so near their sacred city. My attempts to measure some of the men were not successful; they were frightened to death of the Lamas, so I did not persist. All the Lamas that we met in this part of the world belonged to the yellow or orthodox sect; but in Ladak the Lamas wore red, the distinguishing sign of the unreformed Church. I descended the valley some distance, and climbed a mountain, hoping by the aid of my telescope to see some of the monasteries round Lhasa, but a high intervening range cut off the view. From this point we were 48 or 49 miles from Lhasa. More negotiations followed. We declined to abate our demands, which were that we should have an interview with the Dalai Lama, stay a couple of days in Lhasa, and return to India by the Jelap La and Sikkim. Two more high officials with several smaller Lamas then arrived. One was said to be the governor of Lhasa, the other head of the soldiers. "Back the way you came, and at once; those are the orders of the Dalai Lama, which must be obeyed," was the burden of their song. After some days, finding that we would not give way, they showed the first sign of weakening by offering to let us return by China; then they tried to induce us to go to Ladak by the Chang; and finally they announced if we would only re-cross the pass we could go where we liked, and by whichever way we liked. We still remained pig-headed, and they wrote for more instructions. They seemed to be terribly afraid of poison, and would not touch our tea till we had drunk some first. They received with incredulity my statement that in England a poisoning case was not only exceedingly rare, but that it was looked upon as a particularly odious crime.

The Lamas had brought a trader with them as interpreter, Wohabjew by name; he had made six trips to India, and spoke Hindustani fairly well; with him we had long talks. He said the present Dalai Lama is about twenty, and that he was to come of age that November; then the Rajah of Lhasa, who acted as regent, would lose his power and retire into private life. He went on to say that the two last Dalai Lamas had died between the ages of eighteen and twenty. It seems to be a peculiarly fatal period in Dalai Lama life, as the death-rate was

much understated. The last four Lamas, instead of only two, having been reincarnated about those ages, I am curious to hear if the present one has followed the example of his predecessors. This regent has held office for forty years; he doubtless, therefore, is in a position to give some interesting details of the last illnesses of two Dalai Lamas. It should be explained that the soul of the Dalai Lama never really dies; it descends to some infant, whom it is the business of the Lama priesthood to discover. I could not make out by what particular signs the new Dalai Lama is identified, but the Lamas with whom I conversed would not admit the possibility of a mistake. When found he is brought in great state to Lhasa, surrounded by crowds of Lamas, who educate him for the position he is so seldom allowed to fill. The present Dalai Lama was discovered in baby form at Thokpo, five days from Lhasa; his father was a Zamindar, but both parents are now dead. His three brothers are alive, and have risen with him, and are now great people in Lhasa. The Teshu Lama at Shigatze is also under age, being a boy of twelve or thirteen, who, during his minority, is under the tutelage of Lhasa. When a Tibetan Lama or layman dies, they carry the body to a mountain, cut it in pieces, and the vultures do the rest; and they entreated us to let loose a vulture we had captured alive, saying there was no means of knowing who he might represent. But when the Dalai Lama dies, he is embalmed, and they insert gold and jewels into his face to the value sometimes of one or two lacs. The three great incarnations, the Dalai Lama, Teshu Lama, and the Taranath Lama, are all equally holy, and their sedan chairs, when in Lhasa, are each carried by eight bearers, but the two Chinese mandarins are only allowed four bearers apiece.

The Lhasa merchants are forbidden by the Deva Jung to use the Jelap-La and Darjiling road, and are compelled to travel either by Bhutan, where they would certainly be looted, or Nepal, where, in addition to a tax of 5 Rs. per head, they have heavy transit duties to pay. Last spring a large deputation of over a hundred merchants asked the regent to open the Darjiling road; but he refused, declining to give a reason. Wohabjew did not think Tibet could long remain closed, and all the merchants would be delighted when they could come and go as they liked. The Tibetans living near the Jelap-La travelled backwards and forwards, but no Lhasa or Shigatze man can go direct to Darjiling. One of the Lamas had been on the frontier during the Sikkim row, and said he was quite aware of the power of the Indian Government, but the other Lamas had lived all their lives at Lhasa, and thought themselves all-powerful, and had no notion how weak Tibet really was. Another Lama told me that a high official left Lhasa to fight the Japanese; he cut a lot of sheep in pieces, so naturally after that the Japs had no chance, and were utterly defeated. A Tibetan announced he could cure one of our sick horses, and he poured some

medicine into its right nostril. He told us, had it been a mare, he would of course have treated the left nostril. His nostrum was a success. Many of our beasts fell sick here, and I think the one he doctored was the only recovery we had.

The people here wear such heavy earrings that, to prevent the lobe of the ear being torn by the weight, they support the earring with a strap over the ear. They rarely have a pair alike. Some of the rich Lamas had very large pearls mounted in gold, with turquoises. They wore a kind of semi-Chinese costume. Their handkerchiefs were made in the form of a sachet quilted inside, with which they simply pinched their noses; they had every appearance of being heirlooms. The boots of the common people were made of parti-coloured cloth reaching nearly to the knee, with horsehair soles knotted together with twine. Their coats are cut very long, but were strapped up short round the waist with a big fold, and only allowed to reach to the knee. At night the garment is let down to cover their legs. Most of the people slip their coats off the right arm and go about bare to the shoulder. They wear a sword stuck diagonally through their clothes, only the handle and the lower part of the scabbard being shown. Those parts are usually highly ornamented, the centre of the sword, which is hidden, being, for economy's sake, left quite plain; besides, they are armed with a match-lock gun, and many of them carry a lance in addition. The people here, both in regard to clothes and jewellery, seem to be pretty well to do; but the further west we went the poorer the people became, though even there nearly every man had a horse, and in no part of Tibet did we meet with such rags and apparent poverty as in Eastern Ladak.

Meanwhile, the Lamas were at their wits' end. We had food for a couple of months, so they could not boycot us. We had sufficient animals, and the snow-pass by which we crossed the valley was liable to be closed early in September, an event for which we were praying. Everything promised well, for they had no resource left but force, which they palpably dared not use; and, absurd as it may sound, so insecure did they feel of their position, that, though there were upwards of five hundred men camped just below us, and more above, they actually had destroyed all the bridges between us and Lhasa. The Goring Tangu valley, 16,600 feet, in which we were camped, was very wet and cold. Mrs. Littledale, who had been more or less indisposed for some months, now became so alarmingly ill, we saw it was impossible to remain here much longer. The Lamas wrote to the Deva Jung, saying that we wished to hurry through to India for medical advice; but directly the Lhasa people found that we could not stay, then their tone altered, and they reverted to their original order of "Back the way you came." I explained to them that the passes would be closed, and it meant certain death; but nothing our Lamas said would alter that determination. We could not understand why there was such a long delay between sending this

letter and the arrival of the answer, till the messenger told us, privately, that he had had to take it to all the lamaseries round Lhasa, at each of which there were meetings of Lamas. Altogether, I am afraid we caused a considerable flutter in the Lama dovecot.

Until Mrs. Littledale's illness, our prospects had looked so bright that for motives of economy we had refrained from writing and offering a bribe direct to the regent; but now I wrote, proposing to give to their temples fifty silver yamboos (1 Yamboo = £8 or £9) if they would allow us to pass through Lhasa and go to Sikkim. The Lamas with us would neither send the letter themselves nor allow one of our men to take it. We felt that things had come to such a pass that we were quite justified in taking extreme measures, so we saddled up our horses and notified the Lamas that we were going to fight our way through to Sikkim. That brought them to earth again, and they said they would supply us with everything we required, and we could go back to Ladak; to which road I consented, much to Mrs. Littledale's indignation. It was heart-breaking work, having to turn back when so near our goal, but it had to be done. I absolutely refused to go back a yard unless they first gave us a circular letter ordering all Tibetans to help and not delay us. They were reluctant, but we were firm, and they gave way. When the letter arrived, fortunately one of our Ladakis could read Tibetan. The precious document said that we must go north, and not put one foot in Tibetan territory. This we indignantly tore up and demanded another, which, after prolonged negotiations, was eventually given us. Mrs. Littledale was now so weak that riding was impossible, so we sent down to Lhasa for wood and manufactured a litter for her, and broke in some of our mules to carry it. On inquiry, we were told that there were then only two litters in Lhasa, one belonging to the Dalai Lama, and the other to the Chinese Amban. We sent polite messages to them both, inquiring their terms, but neither would sell. We thought it prudent to purchase about fifty horses, and sent to Lhasa for what we required to make up three months' supply for the party, so that we hoped to be quite independent of the natives should they prove faithless. The soap they sent us was scented, made like cucumber and tomatoes; the tobacco, Wills' Bristol Bird's Eye; so they are evidently quite up to date. They had used a queer old print of a London church some time last century to wrap up some grocery. We started on August 29 on our long march of 1200 miles to Kashmir. It being quite impracticable for mules to take the litter over the Goring La, Mrs. Littledale was carried by twenty men to the foot of the glacier. She rode a yak over the ice, and the men carried her down the rocks the other side. The work at that elevation was of such a terribly hard character, that I promised the men two rupees apiece per day if they got her over safely. The Lamas took the money, and the men got nothing. And it was just the same with

the horses and supplies; we paid exorbitantly for everything without bettering the poor unfortunate peasants one farthing. It really seemed to us that the only way to get even with these gentry would be, firstly, to vow and declare that you had entered the country by the way you really wished to leave it, and then, when they said, "Go back to whence you came," you could gracefully acquiesce; secondly, plead utter poverty: they must get you out of the place, and your not paying would affect nobody's pocket but the Lamas—the peasants, of course, getting nothing in either case.

We had agreed to go north to the Sachu Chu, the river we had crossed with our boat when going south, and then go west through Ladak; and the Lamas had promised we should have men and yak to help us, but they broke faith in this, as they had repeatedly done in other matters previously. After crossing the river the Lama and his men returned, leaving us alone. We had become so accustomed to finding our own way that we did not in the least want guides, but we did require help badly with our caravan, as two men were required for Mrs. Littledale's palki, two for the donkeys, and one for the sheep and goats; it only left five men for about sixty horses and mules, and our new animals, always having been accustomed to be led on a march, the Tibetan system, finding themselves loose, used to gallop off like mad things and scatter their loads all over the country.

Almost without exception every lake in this country has greatly decreased in size, and the process is still going on; there are lines of gravel, sometimes six or eight, one above the other, showing the height the water once had been, and marks high up along the rocks, as much as 200 feet above the present water-level, were occasionally found. On the sides of the hills surrounding the Lakor Tso the marks were peculiarly distinct. In past times the size of the lakes must have been vastly larger than at the present day. I noticed in several instances that when lakes had divided into several smaller ones by the subsidence of the water, the top of the ridge of land separating them was usually about 40 yards wide, perfectly level, and having the appearance of an artificially made dam or railway embankment. There was capital grazing in most places, the grass much resembling the bunch grass of the Western States. The country ahead promised to be easy travelling, and so it proved to be—valleys joining on to each other with gentle passes right up to the Ladak frontier, a great contrast to the country south of Cherchen, which resembles a ploughed field on a gigantic scale; and as our course unfortunately did not lie up a furrow, we had to cross from ridge to ridge. For the greater portion of the way from Zilling Tso to Ladak, our route lay to the south of that taken by Nain Sing, Captain Bower's, of course, being north of that again. We wished to have kept about 60 miles further south and traversed the Dokthol province, but feared being delayed had we done so.

We were joined by a couple of men, who said they had been sent by the headman of Senja Jong. After some days they provided yak for us to save our own horses, and we paid hire for them, which they put in their own pockets. When they left, they sent for a local official, and told him that he was to provide us with yak, and hand us over to the next district official, and then they said it was quite unnecessary to pay any hire for the animals provided. Wishing to be honest, we at first did pay; but when we found that the Kushoks, Tibetan officials, took from the yak-owners every atom of money we gave them, we concluded we would save our pockets. Occasionally an opportunity would occur of giving a little present surreptitiously. When a new Tibetan official is appointed he sends presents to his superior, which gifts have to be repeated every third year; they consist of horses, sheep, cloth, etc. The official does not give the present out of his own pocket, but everybody in his district has to contribute. On one occasion our large Turki dog went for a Tibetan dog, and, after vanquishing him in a free fight, proceeded, as was his invariable custom, to lie down on the top of his foe with his tail curled tightly on his back. The other dog gave most piteous, heart-rending howls, all to no purpose; suddenly our dog jumped up with a piercing yell, and bolted away with his tail tight between his legs, and began to bite his paw viciously. It appeared that he had knocked and held the other dog down on the embers of the cook's fire; but things bore a very different complexion when his own foot went into the ashes.

We were travelling as fast as we could, for not only was it necessary to get medical advice for Mrs. Littledale, but we were afraid that we might find the Chang La and Zoji La closed, and in consequence the mortality among our animals again became heavy. On September 22 we sighted some very volcanic-looking mountains; one was a great dome-shaped mass of black lava, and its summit was quite 4000 feet above our camp; another was streaked with red. No Tibetan is allowed to pasture his animals out of his own district; if he does, he is liable to have them seized and have to pay a fine; and nobody except Lhasa people are allowed to work at the gold mines. We passed a good many abandoned gold diggings. The work is done in summer with shovel and pan; in winter, of course, it would be impossible—the water would freeze. Previously the gold-workers had done well, but last season had been disastrous, and little gold was got. After leaving the Tengri-Nor on our return journey, we never saw but one lot of Tibetan antelope the whole way to Leh, but we passed through a grand Ovis Ammon and Burrel country; we used constantly to see them and ravine deer as we marched along.

On October 10 we saw ahead the snowy mass of the Aling Gangri. Two or three years before one of our men had been close to there trading from Leh, and recognized it, and all the Ladakis were wildly excited at

the thought of being near home. While at Chukchuka, he said, news reached the Tibetans that a sahib (Captain Bower) had passed to the north, and the intelligence was forwarded on to Lhasa. A very busy, important Tibetan arrived in camp just as we were starting, and ordered us to immediately return to the Tengri-Nor, from which point we were to be sent back to Cherchen—the way we came, only a trifle of about 1500 miles. He said it was no use talking; here was a letter from the Deva Jung, and back we must go. I made one of the Ladakis read it. It said we were to be turned back wherever we might be; nobody might help us, and we were not allowed to put one foot in Tibetan territory. It was written the same day, and signed by the same Lama that gave us our letter—a pretty piece of treachery. This old villain, the head Lama, was so very sanctimonious, that when I insisted, in the Goring Tangu valley, on having every word of our treaty thoroughly explained to me, he kept saying, "I am an old man, and shall soon die; do you think I wish to cheat you?" I showed the new arrival our letter, ordered the men to load their rifles—on doing which there was a general scattering of the Tibetan escort—our donkey-men, who had gone on ahead and had been turned back, were told to start, and the Tibetan was informed that his life was not worth a minute's purchase if he dared to make any attempt to stop them or us again. I never saw anybody so crestfallen; I really felt sorry for the fellow; he had come up a very big man indeed. Disregarding all his entreaties to stop, we marched on, and the Deva rode off to his chief for fresh instructions.

There were two ways we might have gone to Leh, one by Gar and the Upper Indus, the other by Rudok, and we were undecided which to take, when our official returned and said if he could not induce us to return we were to go by the Indus, but under no circumstances were we to be allowed by Rudok. That settled the question, and we started at once for Rudok. Not being able to carry all our things—for they declined to give us yak—we left behind a lot of stores, and told the headman that we were going to reside in the monastery until our own animals were sufficiently rested to carry all our things safely to Leh. Our Ladakis informed us that this man's predecessor in office had on one occasion gone to Leh, where he was promptly put in jail by the Wazir for having defrauded some Ladakis who had been trading in Tibet. The Deva, unfortunately, let out that he had to visit Leh on important business in the spring; that was too good an opportunity to be missed, so our men went for him on every occasion. Jail for life was the least he could hope for the instant he entered Ladak if these sahibs lost one rupee's worth of property. The threats were quite enough, and we had hardly started before they brought yak and were loading up our abandoned things.

The weather had turned very cold, and our clothes were tattered and torn. My nephew, who had worn out his nether garments, found,

like O'Brian Lynn, the hairy side of a sheepskin distinctly comforting. If we either of us forgot to take the bread to bed, we found a frozen loaf made a poor breakfast. The difficulty of dressing in the morning, with the thermometer 6°, 8°, and 10° below zero in the tent, was overcome by not undressing over-night. Wherever our breath touched the sheet was ice in the morning; and on one occasion Mr. Fletcher found that before he could lift his head he had to loosen his hair from the pillow, to which it was frozen fast. In some of the rapid mountain-streams we noticed that the water froze from the bottom. I understand the same phenomenon is sometimes seen in the Thames at Oxford.

To avoid trampling needlessly on the feelings of the people, we did not enter the town of Rudok; and the Deva's face, which had had a very anxious expression till I turned away from the town, beamed with satisfaction. Rudok is very picturesquely situated, its site covering a steep hill, which stands isolated on a plain. On the top is a large palace something similar to that at Leh, and several monasteries painted red. All the houses, which were in tiers, had once been whitewashed, but the colours had toned down, and, with the remains of an old wall round the town, the whole effect was extremely good. At the foot of the hill, about a mile away, there is another monastery. Some Ladakis trading at Rudok came out to meet us, and our men had a long talk with them. Afterwards I asked the nicest of our Ladakis whether he had good news of his wife. His answer was, "I never thought of asking." This after a year's absence! We passed some fine Mani stones, some of them very artistically carved. I annexed one, but generally when I stopped some Tibetans would stop too, so I never got a really fine one. After leaving Khotan, we found that somebody had palmed off upon us a two-year-old donkey; we tried to exchange it several times in part payment for other donkeys, but, not being able to get rid of it, we decided that it must just carry its load as long as it could. To the astonishment of everybody, it proved to be the best donkey we had; never sick or sorry, and always fat, he eventually became a great favourite. On nearing the Ladak frontier, he and another were the sole survivors of the donkeys; but, to our great regret, the intense cold finished him when close to the journey's end.

On October 27th we entered Ladak, at the village of Shushal, at which point, having completed my survey of 1700 miles from Cherchen, I put by my instruments, not without, however, a lingering regret, for, in spite of the cold, that kind of work has a great fascination for me. No names are entered on the map that have not been obtained from at least two independent sources, and the men were made to repeat the names over and over again, till we got their pronunciation right. We passed along the south shores of the Pangong lakes, whose clear waters reflected the beautiful colouring of the surrounding hills, which

showed distinctly water-marks high above the present level of the lakes.

We had a fine day for crossing the Chang La, and the snow there had been trodden solid by flocks of sheep carrying grain to Rudok. At night their loads are built up like a wall, to protect the flock from the wind, and from the walls of sacks there are ropes fastened in parallel lines, to which the sheep are tied at night, so that they can be conveniently loaded in the morning. The salt or grain is packed in two bags joined together on the top, which is placed across the sheep's back and sinks into its fleece. A rope is placed under the sheep's tail and another across its chest. The load seems to ride perfectly well, and never shifts. Two or three men will look after as many hundred sheep, each carrying 20 or 30 pounds.

Passing the monasteries of Chimrai and Hemis, we arrived at Leh, in rags and tatters, on November 2, finding quite a genial climate—a tremendous change from what we had been having. From April 26 to October 16 we had never descended lower than 15,000 feet, and for four weeks of that time we had been camped over 17,000 feet. Finding the turns on the Kashmir road were too sharp for my wife's mule litter, we took it to pieces and made a much lighter and shorter one, in which she was carried by coolies the rest of the journey. We just got over the Zoji La in time. Two days later heavy snow fell. We reached Srinagar the middle of November, where at last we obtained the medical advice which our poor invalid needed so sorely. Out of all the animals that left Cherchen, including those we purchased at Lhasa, 160 or 170 in all, only two ponies and six mules reached Srinagar; more just struggled in to Leh, but, as they were incapable of going further, we gave them to our men as backshish.

Before the reading of the paper, the PRESIDENT said: I am sure all present are delighted to welcome home Mr. Littledale, who has returned from a most adventurous expedition, having traversed Tibet from north to south, and made a very important discovery of new country; and I am sure we all feel deep sympathy with him and Mrs. Littledale in that she has been attacked by a severe illness, no doubt partly brought on by the hardships of the journey and the rigorous climate, but I trust she will, with care, soon recover her usual health again. This is the third time we have welcomed Mr. Littledale on his return from important exploring expeditions in Central Asia. The first time was in 1891, when Mr. and Mrs. Littledale returned from their journey across the Pamirs; the next was in 1894, which will be fresh in most of our memories, when he gave us a narrative of his very remarkable journey across Central Asia. Now we are about to listen to an account of the severe work he performed in accomplishing a very important geographical achievement, traversing for the first time the lofty plateau of Northern Tibet. I will now call upon Mr. Littledale to read his paper.

After the reading of the paper, the following discussion took place:—

The PRESIDENT: I am sure the meeting will be struck by the extraordinary resolution shown by Mr. Littledale in performing so remarkable a journey. A

great number of interesting points have been raised in the paper. To allude to one, I may first of all mention the flora, which, from Mr. Littledale's account, would appear to exist not at all, for he has only mentioned the *chi* grass and fuel called *bortza*, which may or may not be a plant. But, fortunately, we have present this evening Mr. Thiselton-Dyer, who has, I believe, examined the collection of plants brought back, and I trust he will give us some account of the flora of this region, for I think that the flora of these very elevated Alpine regions is always extremely interesting.

Mr. Thiselton-Dyer said that it was a happy circumstance that Mr. Littledale had been able to save his parcel of dried plants from the shipwreck which befell the rest of his collections. Its examination, which is not yet wholly completed, proved extremely interesting. It contained between sixty and seventy species, of which probably ten are new to science. "They were nearly all found in the Goring-Tangu valley (about 16,000 feet) on the south side of the high range of mountains which lie between the Tengri-Nor and Lhasa." The precise position was lat. 30° 12′ N., and long. 90° 25′ E.

One of the most striking features of the collection is the large preponderance of European genera; one might, in fact, say of British, because the large majority are represented in Britain. Out of between forty and fifty genera, there are only half a dozen of which this is not the case. Five species, *Aconitum Napellus*, *Potentilla fruticosa*, *Myriophyllum verticillatum*, *Taraxacum palustre*, and *Polygonum viviparum*, are actually found in this country. The first is perhaps an introduced plant; the Myriophyllum is an aquatic, the distribution of which is usually wide; but the two last are characteristic mountain forms with us. And in *Potentilla fruticosa* we have the most striking link between the two floras, as, though a rare plant, it is undoubtedly native in the north of England and the west of Ireland.

The flora of Western Tibet has long been tolerably well known. Eastern Tibet, on the other hand, was stated by Sir Joseph Hooker in 1855 to be "quite unknown botanically." Since this time our knowledge of the northern belt is the result of the journeys of Prjevalsky and Potanin, of Captain Bower and of Mr. Rockhill. The publication of the collections of the two former travellers was interrupted by the lamented death of Maximowicz. Those of the two latter were worked out at Kew, and the results are published in the *Journ. Linn. Soc.* (vol. xxx., pp. 131–140). Of the flora of the country between the neighbourhood of the Tengri Nor and Sikkim our knowledge is still extremely limited, and is much enlarged by Mr. Littledale's work. Sir Joseph Hooker, in two days' journey, only succeeded in collecting some fifteen to twenty species. In 1882 the Royal Botanic Garden, Calcutta, obtained some plants through a native collector, Ngyen Gyatsho, who accompanied Sarat Chandra Das in his journey to Lhasa; the collector did not, however, get further east than Gyatse Jong. In 1890 Prince Henri d'Orleans, like Mr. Littledale, attempted to reach Lhasa from the north, but apparently collected no plants in this part of his journey.

The conditions under which the Tibetan flora exists are perhaps unique. Long ago General Strachey expressed his conviction that flowering plants existed up to 19,000 feet (*J.R.G.S.*, vol. xxi. p. 77). But 18,000 feet appears to have been the highest observed level till the receipt of the collections of Surgeon-Captain Thorold, who accompanied Captain Bower. The conditions under which vegetation can exist in such circumstances are of course extreme. It is hardly necessary to say that there are no trees and no shrubs, nor any plants above a foot high. Very few indeed are above 3 inches out of the ground. General Strachey estimated that in the part of Western Tibet which he visited, "not one-twentieth part of the surface was covered with vegetation" (*Journ. Linn. Soc.*, vol. xxx. p. 101). A very large

proportion of the plants are herbaceous perennials, with long tap-roots, a rosette of leaves lying on the ground, from the centre of which springs the dwarf inflorescence.

The flora as a whole belongs to the Arctic-alpine division of the great northern region. But, as usual, this contains a purely endemic element, and also one related to the neighbouring area to the south, from which it has been perhaps recruited. Of the characteristically Tibetan plants obtained by Mr. Littledale, some had been previously obtained by Prjevalsky, Thorold, and Rockhill. Of the species not exclusively Tibetan, some extend to the Himalayas and the mountains of Western China. Of the typical Arctic-alpine flora, two species may be singled out as representative. *Lychnis apetala* extends to Spitzbergen, and there is a very interesting form of the well-known Edelweiss, *Leontopodium alpinum*, which was also collected by Mr. Rockhill. The total absence of Gentians in Mr. Littledale's collection is remarkable. It is interesting to note that the single fern collected, *Polypodium hastatum*, was previously only known from Eastern Asia (China, Japan, and Corea). Among the new species is a striking grass. Of two fungi in the collection, one is new.

The PRESIDENT: I think there are very few countries near the borders of British India with which Colonel Woodthorpe is not acquainted. I know he has been nibbling round Tibet for many years, on both sides; and as there are very few people better acquainted with the country beyond the Indian frontier, I hope he will address us.

Colonel R. G. WOODTHORPE: Rudyard Kipling, in the course of a distinguished literary career, said a few true things, but never a truer than that sentiment which he puts into the mouth of Tommy Atkins, when he says, "If you've 'eard the East a-calling, you won't never 'eed naught else." There is a fascination about the East, and such travelling as Mr. Littledale has told us of to-night fascinates all those who have ever attempted it. I have been exceedingly pleased to listen to Mr. Littledale; I have felt that what I have accomplished has been as nothing compared to his gigantic performances. But though I have done little, I have done enough to appreciate the difficulties and dangers through which he and Mrs. Littledale have passed so bravely and nobly. His anxieties about the apparently impassable mountain ranges ahead, anxieties about food and scarcity of water, and his joy on surmounting these difficulties of them, have found a responsive echo in my breast. He has borne testimony to the good conduct of the sepoys with him. It is an experience which has also been my own. In all these little expeditions I have found the native soldier, whether Pathan, Sikh, or Gurkha, always the truest and most faithful friend the explorer could have, whether on the north-east frontier, or in Afghanistan or Chitral. I have also found my sepoys keen for a fight. Once in Afghanistan I was with a small force which was sent up to turn some Afghans from a mountain-crest which commanded the camp. I happened to have got separated from the rest of the force, with one or two Gurkhas and a Havildar. There were some Afghans in a small *sungar* just ahead, and, as it was more dangerous to remain out in the open than to get in the shelter of the sungar, we rushed it. The Afghans, not knowing how small a party we were, bolted down the hill. I wanted to stop till the others came up, but the Havildar said, "I must go out and fight them." I said, "If you do, probably you will get killed." He said, "Never mind; it is absolutely necessary to cut up some of these scoundrels with my kukri." You never need urge these men on; they require, rather, to be kept back. They make it sometimes difficult for an explorer, as they are rather too anxious to fight.

Mr. Littledale told us that the Tibetans thought the telescope would enable one to see through opaque substances. That is a mistake common enough among

all wild or semi-civilized tribes. Last year, on the Mekong, I was asked by a Buddhist priest if a telescope would not enable us to see through a man's clothes to the body. He had a proleptic vision of Prof. Röntgen's discovery. I noticed Mr. Littledale observed how difficult it is to pay money to the men who really earn it. This was our experience. I remember this was the case especially in Chitral, when I made an expedition with Sir William Lockhart. Many of Mr. Littledale's pictures have recalled my experiences there, which were most happy, in company with that most generous and gallant chief and charming companion. There each morning the coolies were brought up to us to carry our luggage, but at night we were not allowed to pay them; we had to pay the head-men, who came up for the money, which never found its way into the coolies' pockets.

Sir Henry Howorth: One of the facts we all ought to know is, that the President, whose modesty prevented him from telling it, has edited a very interesting book about Tibet, written by a famous traveller, Bogle, one of the few men who have reached Lhasa. This particular district is the most interesting enigma in all Asia. I have written fat books about the history of Tibet, and the tribes from the Volga to the Yellow Sea, who, whether they are remote or near, whether Mongolian or Southern Turkey tribes, derive their teaching from Lhasa. I feel that our officials put great bars in the way of Indian civilians making their way across the Himalayas, and since the days of Hodgson, who collected more real information about Tibet than any other civilian, we have never had the opportunity of entering Tibet from the south. It has always been from the north that the attempts have been made, by Rockhill and others, culminating in the journey of our friend. Let me commend to you an older authority, who knew the district well and who fought on its borders frequently, named the prince Haidar. This wonderful journey was made, and is described in an extraordinary book published by a great traveller, Mr. Ney Elias, months ago. It was written by a kinsman of the man who founded the Empire of India, and is entitled the 'Tarikhi Rashidi.' It is a disappointment to some of us that Mr. Littledale was only able to get within 43 miles of the Mekka of this Central Asiatic world; although we have accounts from older days, it would be interesting to know what life goes on there now. It is a great puzzle to know how these wild tribes and the Mongols from Lake Baikal to the Volga can understand and become attached to such an intricate and elaborate system of theology as that hidden behind the lama medium—a sort of Blavatskism gone mad. We do hope very much indeed that Mr. Littledale will make another venture, whether he takes his wife or not on such a dangerous journey. I think a man who could get within 43 miles of Lhasa would probably succeed next time. I am sure he would bring back a great many valuable lessons for us. We have hardly any notion now of what goes on there, beyond one or two accounts derived from Lamas who have found their way to Bhutan. We want some man with the power of picturesque description and also a great hunter, for Mr. Littledale was the first man to bring the wild camel to England, and those who have not seen it should go to the Natural History Museum, and see it there stuffed. You will pardon my having intervened this discussion, but I have taken much interest in this journey and the history of the country Mr. Littledale has traversed. It has been a delightful revelation to myself, and I could not help recalling to your memory that your President, with all his versatile gifts, did a wonderful thing for some of us when he edited that wonderful account of Lhasa I mentioned.

Mr. Delmar Morgan: I should like to pay my tribute of respect to the memory of General Walker, whose loss Mr. Markham has referred to this evening. Having been personally known to General Walker for many years, and associated with him

in some of his geographical work, I have always been impressed with his great knowledge and scientific attainments. I feel sure that the whole Society must feel his loss very deeply.

The paper we have just heard contains very many points of interest. We cannot but feel interested in the cordial reception which Mr. Littledale mentions as having been given by the Russian authorities. I am told that one of those who assisted and forwarded his journey in every way was that well-known traveller Colonel Grombchevsky, and it speaks very highly for him that, notwithstanding the disappointment he felt when exploring some years ago the valley of the Upper Yarkand, near our frontier, when he asked, but did not obtain, permission to enter British territory, he should have welcomed our traveller. Another point of view, the commercial, after what Mr. Littledale has told us, is of importance, with reference to the great trade in wool, and I think it would be a good thing were Englishmen to keep an eye on that trade. Yarkand has been for many centuries known as a trading centre, and it is from there, if I am not mistaken, that the wool from which the celebrated Kashmir shawls are made comes. From the geographical point of view, Mr. Littledale's paper is of great importance. His route—or hardly a route; it is more a track, made for himself across the most inaccessible part of Northern Tibet—lies a little to the west of the route of M. Bonvalot and Prince Henri of Orleans, and a little to the east of the journey made by M. Pevtsoff, who succeeded Prjevalsky in 1890, and who, starting from the oasis of Nia, crossed that very high range, which is known locally as Akka-Tagh, and marked on some maps 'Prjevalsky' range.

The PRESIDENT: I was anxious to discuss several geographical points, suggested by Mr. Littledale's paper, but I fear it is getting late. I will, however, say a few words respecting the chain of mountains which Mr. Littledale actually crossed, and which he mentions as throwing up peaks 20,000 feet high. I am sorry to say that on the map we have to-night that chain of mountains does not appear, which only shows how important it is that further exploration should be conducted in Tibet. I have called that range the northern range of the Himalayan system. I remember Mr. Trelawney Saunders was anxious to name it, and he has done so on a map he drew for me, the Gangri range, after the knot of peaks which connects it with the Korakoram; but Brian Hodgson has called it the Nyenchen-tang-la, as does also Mr. Littledale himself. These mountains are of the greatest possible importance and interest; they have only been crossed by native explorers and by Mr. Littledale opposite the Tengri-Nor, and in the whole length from Tengri-Nor to the Mariam La pass no one has crossed them, so far as we know. One of the last suggestions by General Walker was that a rough survey should be undertaken of these northern parts of the Himalayan system, and I believe nothing in Asia is of greater geographical importance than the exploration of this range of mountains, which I trust geographers will agree to give some name to, and next time we have a map of Tibet in this room I shall take care that they are portrayed upon it.

We now only have to thank Mr. Littledale for his most interesting paper, giving us an account of a journey which has seldom been equalled for its extraordinary hardships and the resolution with which they have been overcome. We have heard from Mr. Thiselton-Dyer that very important botanical results have come from Mr. Littledale's collection of plants, and I must express my own admiration for the splendid scientific work he has done for geography—for the way in which he got up every morning, without, I believe, missing a single one, to take observations regularly, from the time he started until he reached Leh, and his dead reckoning shows that he did his work with most remarkable accuracy. I believe it was only a mile or half a mile out in 850 miles on comparing his dead reckoning with a position

fixed by observation; 200 miles further west the dead reckoning agreed within half a mile of the longitude obtained by an occultation observed by Mr. Littledale, and compiled by Mr. Coles; and at Shushal, near the Ladak frontier, where the survey terminated, there was, after a traverse of 1700 miles, only a difference of 1½ mile between Mr. Littledale's position and that given by the Trignometrical Survey of India. We not only have to thank Mr. Littledale for an extremely interesting evening, but for the valuable scientific work done for geography, and I am sure you will all join in a cordial vote of thanks.

Note on Mr. St. George Littledale's Map.—The instruments used by Mr. St. G. Littledale for making his route survey and fixing positions by astronomical observations were—a 6-inch sextant, a 3-inch theodolite, a telescope by Ross, hypsometric apparatus, three aneroids, a clinometer, and a prismatic compass. All bearings were taken with the prismatic compass on a tripod, and the distances were arrived at by pacing the caravan with a stop-watch. Forty-three observations of north and south stars for latitude have been employed for correcting positions, and the longitude of station 107 has been fixed by an occultation of the star and γ Capricorni by the moon. The accuracy of the traverse survey was confirmed in a remarkable degree by the astronomical observations.

THE FIRST CROSSING OF THE SOUTHERN ALPS OF NEW ZEALAND.*

By EDWARD A. FITZ GERALD.

The South Island of New Zealand, as you all know, is long and narrow, some 500 miles in length by about 100 to 150 miles in width. It lies in a north-easterly direction at about the same distance from the equator as Italy or the Black Sea, so that the mountain ranges might be likened to the Caucasus in respect of latitude. The climate is, however, much milder; snow very seldom falls in Christchurch or Wellington even during the winter months. The whole of my work was confined between the districts of Canterbury and Westland, and the principal object of my visit was, if possible, to discover some feasible tourist route over which horses could be taken from the arid plains of the Mackenzie country to the west coast, so marvellously beautiful with its nearly tropical vegetation and its great glaciers flowing down almost to the sea. There would also be a practical use for such a road, as it would open up to the gold-diggers an easy path whereby they could get their supplies, and at the same time send their produce to the great towns on the east coast. Up to the present day they have had to rely on pack-horses led along the beach, nearly 100 miles from Hokitika—a toilsome journey even under favourable circumstances, but after a great rain, when the rivers are in flood, there being no bridges, one is obliged to stop and wait perhaps a fortnight for fine weather. As the rainfall of the west coast varies from 120 to 150 inches a year, it can be easily understood how

* Paper read at the Royal Geographical Society, January 27, 1896. Map, p. 576.

difficult it is to use this route. In the old days, when there was the great gold rush to the west coast, travellers sometimes availed themselves of the primitive method of buying some dilapidated and condemned schooner, and taking her round from one of the east coast ports to beach her on the shore, for there are no harbours on the west coast, and the surf rolling in from the great South Pacific Ocean is too heavy to permit of freight being landed by boats. The New Zealand Government have for a long time recognized the importance of finding such a passage. With this end in view, they have repeatedly sent survey parties up all the main valleys of the west coast, but with indifferent success. Mr. Douglas came nearest to finding such a route; he went up part of the Copland valley, down which I descended from my pass; but he branched off up the Strauchon glacier towards Baker's saddle, and met with impassable precipices. On his return he published an article in the New Zealand Government Survey Report, in which he said that, unless long tunnels were built under the glaciers, no passage could be made. Had he gone up what he himself named the Douglas valley, he would have no doubt met with better success, and I should not be reading this paper to-night.

I came up to my first camp in the mountains from Christchurch by way of Lake Pukaki, stopping near a small galvanized iron building called the Hermitage, set up for an hotel near the terminal face of the Hooker glacier by a company then bankrupt. The inn being closed, we had to pitch our tent beside it, and to rely entirely upon the provisions which I had brought with me, partly from Christchurch and partly from England. There is a kind of a track over which it is possible to get carts for some 50 miles from Pukaki, where the road stops, as far as the Hermitage. Bad luck overtook us on the way: the breaking of one of our axles forced us to bring all our supplies packed on the backs of horses, a task that occupied about three days.

My idea was to climb all the surrounding high peaks, and thus get a thorough knowledge of the country. I was so fortunate as to have with me Mattias Zurbriggen, foremost amongst Swiss guides, who had just returned with Sir Martin Conway from his famous Indian expedition, the exploration of the Karakoram Himalayas. As to the Alpine climbing part of my expedition, I will not dwell here on our many difficulties and obstacles, nor on our hardships from want of provisions and porterage, as it is almost impossible to find in New Zealand a man who will trust himself upon a glacier. It suffices to say that on January, 29, 1895, we scaled Mount Sealy (8631 feet) after four weeks of continuous rain. Next we reached the summits of Mount Tasman (11,475 feet), the second highest mountain in the colony, Mount Haidinger (10,107 feet), and the Silberhorn (10,250 feet); and finally, on February 15, after many attempts, we attained the topmost point of Mount Sefton (10,359 feet), the Matterhorn of the New Zealand

Alps. It was from this peak that I first saw a passage by which it seemed feasible to cross the ranges to the west coast, and a few days later, on February 19, we made an expedition up the Hooker glacier in order to choose what might appear to be the best route.

During the succeeding ten days, the weather being extremely unsettled, I spent some time making smaller expeditions about the various creeks and gorges of the Hooker and Tasman valleys. On these excursions I noticed several small growths of the obtuse-leaved *Fagus Cliffortioides* (the white birch of the settlers). This I found growing in many spots along the Tasman valley—indeed, almost up to the terminal moraine of

THE TASMAN VALLEY, LOOKING TOWARDS THE HOOKER.

the Hooker glacier. The vegetation was not confined to the *Fagus*, but included the *Plagianthus Lyalli* with its white blossoms, several sorts of dwarf conifers, such as *Podocarpus nivalis* and *Phyllocladus Alpinus*. At the snout of the Tasman and Hooker glaciers and elsewhere I found the *Aciphylla Colensoi* (the "wild Spaniards" of the settlers) growing in dense thorny masses, and forming an almost impenetrable barrier to our advance. Another conspicuous type of Umbelliferæ is the *Ligusticum Haasti*, covering the hillsides with its delicate feathery leaves. On the lower slopes of Sefton, great beds of the *Ranunculus Lyalli*, the "shepherd's lily" of the settlers, flourish luxuriantly at an altitude of 4500 feet, the great orbicular cup-shaped leaves filled with morning dew.

Several species of Dracophyllums were conspicuous, among which I note the *D. uniflorum*, which abounded around the Hermitage, and the

D. muscoides, which forms a carpet with its low tufts on the higher slopes up to an elevation of 6000 feet. The white-berried *Gaultheria* was also plentiful.

There were many species of *Senecio*, *Gnaphalium*, and *Olearia*; also numerous species of *Veronica*, *Geum parviflorum*, and *Coprosma fœtidissima*. *Coriaria thymifolia* grew in profusion, with its deeply veined leaves and large black berries. Along the watercourses I noticed *Epilobium crassum* and *E. confertifolium*. The proximity of the Alpine to the sub-Alpine species is very marked.

Traces of an ancient glacial period can be seen all down the Tasman valley as far as Lake Pukaki, at the head of which I noticed many mounds of morainic matter, evidently terminal in their form. Remains of many lateral moraines exist all along the valley. In the whole of my explorations, I did not come across anything which would point to a volcanic period. The general aspect of the valley is rendered extremely barren by its immense watercourse, for the stream frequently changes its channel, thus giving its bed a width of a mile or more.

It was not till February 24 that I set out alone with my guide, Zurbriggen, to cross the divide. The weather now looked settled—that is, as settled as weather can look in New Zealand, for I have seen it suddenly change completely in half an hour, the barometer standing high. We started at 5 a.m., taking with us a couple of 40-lb. packs, containing photographic camera with one hundred exposures of Eastman's films, a few pieces of mackintosh sheeting to cover us at night, and a pot to heat water in; these, together with surveying instruments, writing and sketching materials, some dry clothes, and over a hundred feet of rope, left very little room for provisions. We managed, however, to squeeze in sufficient for a day's consumption. We went up the right bank of the stream to the Hooker valley, walking along the east moraine till we were nearly under what is known as the Ball pass. This leads over to the Ball hut on the Tasman side, a small refuge built by the Government on a bit of land between the Ball and Tasman glaciers. While crossing the Hooker glacier, the mists and clouds in the valley cleared as the sun rose, and the three peaks of Mount Cook, with their great crags and precipices, towered some 10,000 feet above us. We paused to admire the view, when a number of New Zealand Keas (*Nestor notabilis*, a kind of parrot) surrounded us, screeching in a most deafening fashion. These birds live almost entirely in the mountains above the forest lines, and in certain regions they prey on the sheep, lighting on their backs and pecking out their kidney fat. It is believed that they have learned this habit of meat-eating from the offal thrown out from the sheep-runs after an animal is slaughtered. It is incontestably a fact that in certain valleys they have not learned this trick. They are a handsome bird, with brilliant plumage of a dark green colour, the inside of their wings from the level of the pinion being of a

ruby tinge; beneath this bars of bright yellow run across the feathers. They have a most powerful beak, the upper mandible of which is more curved even than in the case of a parrot, and their small black eye gives them a cruel expression. I have found them so tame at times that I have been able to catch them in my hand, especially in unexplored districts where they have not as yet learned to fear man.

We now followed up an old torrent bed, under the saddle towards which we were making, as far as a long gully filled with avalanche

LOOKING DOWN TOWARDS THE MARCHANT VALLEY FROM FITZ GERALD'S SADDLE.

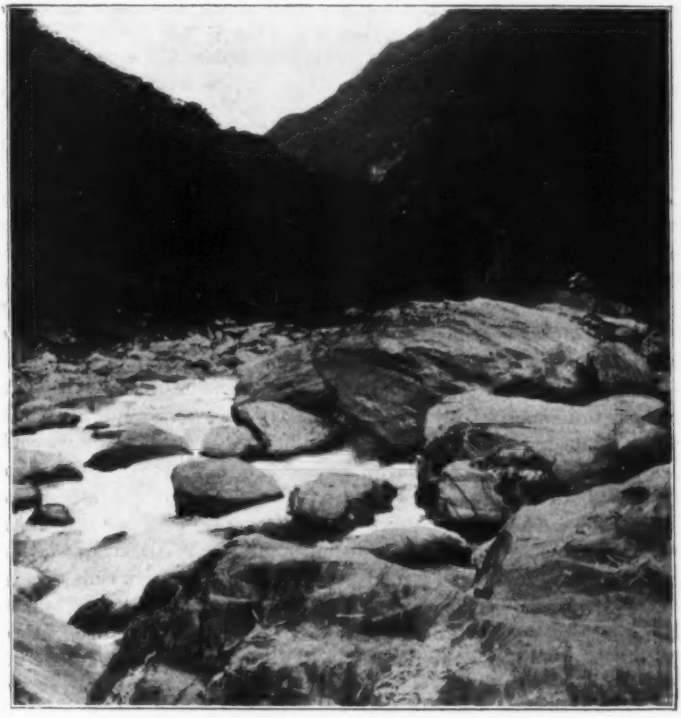
snow. Here we took to the rocks to the left, but, as they were very bad and crumbling, we cut across the gully and scrambled on to the ridge to the right. By taking the next ridge but one we should have escaped all difficulty in the ascent, but the way would have been slightly longer. As it was, we chose the shorter but more troublesome route. At the top of this ridge was a small snow dome, whence our saddle was plainly visible. Proceeding round the base of this, we cut straight down to our pass across a small glacier, reaching it after about twenty minutes'

easy walking from the snow dome. I made out the height of this pass to be roughly 7180 feet above sea-level. The New Zealand Survey Department have named this the Fitz Gerald pass. In many ways it resembles the Monte Moro in Switzerland, leading from Macugnaga to Mattmark. There would be no difficulty in building a bridle path from the Hermitage to this saddle, the snow part being short; while on the west coast side an easy slope of loose stone leads into the Marchant valley, presenting no obstacle to the construction of a path.

Clouds now began to gather again, so we hastened to descend, fearing lest we should be overtaken by bad weather before we could find our way down to the valley. Soon we got down over a succession of easy grass slopes, and, bearing off to the left, reached the Douglas river by 4 p.m. We at once began to descend the valley along the south bank of the river, hurrying on as fast as we could, and keeping close to the river-bed, determined to make as much of the remaining daylight as was possible. Soon the walking became so rough that it was necessary to go farther inland, and to take to the dense scrub on the mountain-side. We tried to creep under it, but, finding this hopeless, endeavoured to crawl over it. This proving equally impossible, our only course was to fight our way bit by bit, lacerating clothes, hands, and faces, only to discover, after an hour's hard work, that we had progressed 150 feet! At this rate we should starve before getting out of the valley; so we returned to the river-bed again, where, by difficult climbing, we managed slowly to work our way over the boulders. It was tedious work and very fatiguing. At 6.30 we bivouacked for the night near a big stone by the river-bed, and at daybreak were off, and once more at the fearful business of climbing over the big stones. About 9.30 we reached the meeting of the Strauchan and the Marchant streams, and flattered ourselves that the worst was over; but, as a matter of fact, it was only about to begin. We had now literally to fight our way down, sometimes over and sometimes under great boulders, with an occasional small *détour* through the forest scrub, where over an hour would be spent in going a distance of 20 or 30 yards. The whole valley was deeply wooded high up on both sides and down to the river; there was but one way through, and that was the river-bed. At 11.30 we started down, but soon had to turn off into the dense forest of scrub, the river closing in here into a sort of gorge, with huge boulders piled up one on the top of another across it so as to form species of bridges, while the stream, now a raging torrent, rushed below in a series of cascades. We forced our way through the maze of creepers and underbush, the walking not being quite so bad now, as we were gradually coming to the regions where large trees grew, such as cedars, totaras, and the rata tree, so frequently found on the west coast of New Zealand—a very hard wood, but, as we found, extremely useful for camp fires, as a log of it will smoulder for days when once properly lighted. We were continually stopped by long

rope-like creepers that wound themselves about us in a curious fashion—supplejacks, as they are called on the west coast (*Rhipogonum scandens*). There were also prickly tendrils named lawyers (I suppose, when fastened to one they never let go).

At 2 p.m. we reached the end of the gorge, where the river widens out as it approaches the Welcome flats. These form a sort of plain about 2 miles long by half a mile wide, evidently formed of old glacial



LOOKING DOWN THE COPLAND RIVER, SHOWING WHERE THE GORGE CLOSED IN.

deposit. The Copland river here opens out, wandering about over an extensive bed, and forming what might almost be called a lake. The flats are certainly well named, for never was a place more welcome to the weary traveller than this expanse of level ground.

We found many species of birds on these plains, among others the blue mountain duck (*Hymenolæus malacorhynchus*) and the Paradise duck (*Casarci variegata*); also the Weka or Maori hen, as they are called on the west coast (*Ocydromus Australis*), a curious kind of wingless bird

about the size of a pheasant. They are to be seen almost all over New Zealand in uninhabited parts, and are of a very mischievous nature, stealing anything bright that they can find. While we were in camp we missed many things, which we afterwards discovered had been taken by these birds. All the birds here were so extremely tame that Zurbriggen undertook to catch some of the blue duck. It was a comical sight. They would let him approach to within a couple of yards of them, and then fly off, only to repeat the same game a few paces farther on. As we had no more provisions, we should have been glad to catch one of these birds, but it was not to be.

From this point there was a fine view up the Ruera valley to Lyttle's peak. We continued on past the flats, and commenced to descend another gorge, scrambling amongst the huge boulders along the river-bed, or tearing our way through the scrub. Here were some of the largest erratic boulders I have ever seen, one proved, on measurement, to be about 300 feet by 200 feet by 100 feet, whilst others seemed even larger. I observed a rata tree growing on the top of one of these, together with some stunted scrub; they were all covered with mosses. At 6.30 it became so dark that we were obliged to bivouac among some big boulders. As the weather looked promising, we did not think it necessary to protect ourselves from rain; but no sooner had we lit our fires and made ourselves comfortable, than it commenced to pour. The rain continued to fall through the night. At 6.30 A.M. we determined to start, thinking it best to advance as far as possible, and, in case the rain continued, seek out some more comfortable bivouac where we could await the fine weather, should we be unable to ford the river. The work was now both dangerous and most unpleasant, for it was almost impossible to keep our feet upon the slippery, wet, water-worn stones, while had we lost our footing we must surely have been drowned, so great was the force of the torrent beneath. The river here runs through a narrow gorge, where we were forced to keep to the banks; but the underbrush was not quite so thick, and we made better time. About two in the afternoon we reached the end of the gorge, and could walk in relative comfort along the river-bank. We passed Architect creek, and came into more open country with many tracks of wild cattle.

We now looked about for a ford, as the river was high, and the sooner we crossed it the better. For a long time all places seemed hopeless, but by five o'clock we reached the point where the river began to spread out over its banks, and in consequence flowed less rapidly. It was not an inviting place, but I determined to try it as our best chance of reaching some habitation that night. After several trials, and with much difficulty, we succeeded in crossing. We stopped for a few minutes to wring out our clothes, and then walked down the river-bank, which was fairly level. In about an hour we passed the place where the Karangarua river joins the Copland river. A little farther

on our attention was arrested by the sight of a fresh footprint in the sand. Our astonishment was great. We silently walked on, neither of us making any allusion to the matter till we reached what appeared to be a freshly cut track through the forest—another surprise! As it was in the direction we wished to follow, we started along it, thinking thus to strike what we thought would be the south road. It was not till later that we learned that no such road exists except on maps.

It was rapidly growing dark, and, although we strained every nerve in the hope of getting through the forest before night, we were at last forced

SHOWING THE CLIFF PRECIPICES COMING DOWN TO THE VICTORIA GLACIER, WITH DAN THE MAORI IN THE FOREGROUND.

to stop, after several falls over trees and into dark holes. We lit the pocket-lantern carried by all Alpine climbers, and resumed our march. We had scarcely proceeded half a mile, when we saw before us a blazing fire and a large tent looming up so suddenly that we were startled. A moment later we heard the gruff voice of a man from inside the tent, and soon he emerged, as much surprised at the meeting as we were. He could scarcely comprehend where we came from, but I gathered from him that the camp was Mr. Harper's, one of the Government explorers, who had just returned from the Twain river, and was now with Mr. Douglas at Scott's homestead, about an hour's walk further on, but difficult to find in the dark. At last, after wandering about in an intricate maze of paths, we stumbled suddenly upon the house. Here they at

once gave us food, of which we stood in great need, after marching three days from the Hermitage with only half a day's provision.

Next day was spent at Scott's house, in making plans for the return journey. There were also some elaborate patching operations to be performed on our clothes, which were nearly torn to pieces by the journey down the Copland. After due consideration of the possibilities of the return journey, I decided to set out the next morning by way of Gillespie's Township, and thence to go up to the foot of the Fox glacier, and return to the Hermitage by a route traversing as many of the glaciers in that direction as possible, in order to gain as much topographical knowledge of the district as I could. The south road not existing, or at least being so impassable that it gave Mr. Douglas three days' hard bush work to travel 7 miles along it, there was no choice for us but to follow down the banks of the Karangarua river to the sea. Then we must ride along the beach, swimming the horses across the Cook river, and so reach Gillespie's Township, whence I was told I should find the road to Sutter's house (formerly called Ryan's), and the foot of the glacier a couple of hours further on. Mr. Scott promised to furnish me with horses, and to let me have the use of a young Maori employed on his farm, by name Dan Te Koeti. We decided to make an early start, as they told me it was impossible to get round the beach at high tide.

On the morning of February 28 we set out about 7 a.m., every possible obstacle having turned up to detain us. It was more than an hour later than we intended. Our party consisted of five, Mr. Harper having joined us. We rode down the Karangarua as fast as our horses would take us, and at 10.30 we reached the sea. The day was a fine one, although very cloudy in the morning, and the surf was already rolling in heavily, so that there was no time to spare, for the strip of beach here is very narrow, and completely covered by the high tide. The beach is at the foot of perpendicular cliffs at least 100 feet in height, in places forming species of bluffs, which I believe to be nothing more or less than ancient terminal moraine-heaps, eaten away by the sea into steep precipices. Probably, therefore, a great glacier once flowed down the whole length of the Karangarua valley, throughout which it is easy to find traces of ancient lateral moraines and glacier action. It seems to me very possible that at one time a great mass of snow and ice may have flowed off Mount Cook over Baker's saddle, which, being only 6300 feet high, and at the present moment not more than a few hundred feet from the Empress glacier, may at one time have formed a channel through which the overflow of ice coming from the slopes of Cook may have poured down into the Strauchan valley, thus greatly augmenting the flow of ice down the Copland, and forming a great glacier to the sea.

Riding along under these cliffs, we passed by a small bay where gold-diggers were at work on the sand. These men scrape together a

scanty living by washing for gold the black sand thrown up on the beach after a storm, the old deposit of the river-bed. They stared at us as though we were an apparition, the presence of a stranger on this coast being an almost unique occurrence. We reached what is called Salt Water creek just as our narrow passage along the beach threatened to disappear altogether before the advancing tide. The passage of this narrow stream is exceedingly dangerous by reason of the quick-sands, and the outlet changes with the tide. Two men have of late years lost their lives in the attempt. The salt spray of the breakers

MOUNT TASMAN, FROM BLACKBURNE'S SADDLE.

already dashed in our faces, and now and again a wave would roll in up to the horses' feet. Seizing the opportunity of a huge receding wave, we dashed safely across, and passed the bluff which Captain Cook fixed trigonometrically with his sextant when he first landed in New Zealand, and which has ever since been the fixed point for all coast survey. We thus reached the mouth of the Cook river, where an ancient character known as California Bill plies a ferry. Taking the horses in tow, we just succeeded in getting across as the boat seemed on the point of sinking under us.

Gillespie's Township was reached by about one o'clock, and we halted

at what is by courtesy called the Gillespie's Beach Hotel. The township consists of some three houses, each a combination of a public-house and a general store for all species of merchandise. The majority of the population seem to consist of children under ten. Gold-digging is carried on here, but they mainly re-wash the sand that was roughly sifted in the first gold rush to the west coast. In the afternoon I visited a dredger set up by a company for washing gold at an original cost of £7000 or so; it has not, however, been found to pay, chiefly, I suppose, owing to the great cost of transportation, all the machinery having been brought down on pack-horses from Hokitika. As we were visiting this dredger, the peak of Mount Cook became visible for an instant above the clouds that had shrouded the hills throughout the day, and formed one of the most superb spectacles conceivable, towering up to a height of some 12,000 feet, and only about 15 miles distant. I now decided to ride on to Sutter's, telling Zurbriggen and the rest to follow as soon as some provisions we were having prepared should be ready.

About ten o'clock next morning we set out for the Fox glacier; but, upon reaching a spot near its snout, we found the weather so threatening that we deemed it more prudent to halt and camp in the woods close by and await better conditions. It poured the whole afternoon and evening. When the night came on, we packed ourselves like herrings in a barrel and tried to sleep, in spite of the sand-flies and mosquitoes that buzzed about us continually. Next morning, though the rain had ceased, we were still enveloped in dense mist. Towards evening the weather cleared, and on the following day, after another night of general misery and discomfort, we started up the Fox glacier. It was slightly misty at first; but then, if one were to wait for an absolutely fine day in these districts, one would have to build a house and stock it with provisions for a year. About seven in the morning we reached the terminal moraine of the Fox glacier. A few minutes took us over it and on to the ice. This glacier is unusually smooth, and unlike its neighbour the Franz Josef, which is so broken as to form practically a huge icefall from top to bottom, a distance of some 7 miles. The Fox fills its bed completely, so that it was possible to walk on to it from almost any point; but in some places, where it had sunk from its old level, and the sheer rock rises in perpendicular precipices, one can stand on the glacier and lean against the rock as against a wall. The result is that there are practically no lateral moraines, but the glacier sweeps down all its *débris*, which accumulates in one huge terminal moraine at its snout, only some 680 feet above sea-level, and only about 8 miles from the actual beach.

We walked up the ice for about 2 miles, keeping to the south side till we came to the first icefall before the Chancellor's ridge. Here we left the glacier and scrambled along the rocks at its side, which form the nearest approach to a lateral moraine that I saw upon this glacier; but even this seemed to be gradually swallowed up and

carried down by the glacier. About eleven o'clock we reached the plateau above the icefall and, regaining the glacier, crossed it at the bottom of the Chancellor's ridge. Here we scrambled up the rocks towards a little cascade which bears down the overflow water towards the Victoria glacier. The mists having lifted by this time, and the sun making its appearance, I decided to send back Dan the Maori, lest, if I should take him any farther, he might be unable to get back over the glacier before nightfall. We stopped some time, discussing what route we should follow next day to reach the Tasman valley. Anxious to see

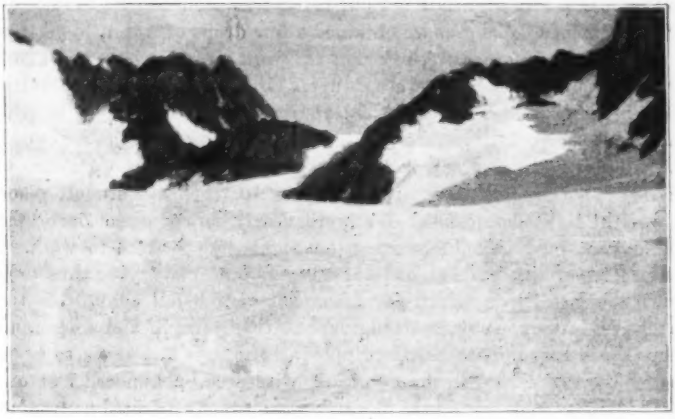
THE HEAD OF THE FRANZ JOSEF GLACIER, FROM BLUMENTHAL GLACIER; MOUNT ELIE DE BEAUMONT.

the great head basin of the Franz Josef glacier, we decided to go up to the Victoria glacier and to seek some feasible pass thence across the range between the two glaciers. Accordingly we scrambled up the rocks towards the Victoria glacier, intending to camp as high upon the Chancellor's ridge as we could that evening. The weather as usual became threatening, and we heard the distant roll of thunder from some heavy clouds banked up towards the north-west. Large drops of rain fell, and by the time we reached the terminal face of the Victoria glacier we were forced to seek shelter for the night. Disbanding, we commenced a search, and presently discovered an overhanging rock

overlooking the foot of the Fox glacier. Here we decided to shelter until the storm should pass. We spent a miserable night. Toward three o'clock in the morning I changed the roll of films in my camera by way of occupation. I always carry a changing-bag for this purpose, but my fingers were so numb that it took nearly an hour to do what I usually accomplish in five minutes. Next we concocted a beverage which we called cocoa by help of a fire made with the remnant of the scrub we had used the night before, whereon we boiled, or rather I should say warmed, about a pint of water. This warmed us a little, and by 4.30 we felt ready to start. Lighting our lanterns, we followed the moraine for about half an hour on the right-hand side of the Victoria glacier; then turned to the left and struck across the glacier itself. By this time dawn was approaching fast, and we were able to look about us and decide upon some feasible route. Before us lay a range of mountains dividing the Fox and Franz Josef glaciers, and between these mountains were a series of passes, for the most part apparently impracticable, on account of the nature of the overhanging glaciers that came down from them on to the head basin of the Victoria glacier. There seemed, however, to be almost directly north of us a pass which we thought would lead to the Fritz glacier, between what we named Mount Gaskell and Mount Anderegg, on the dividing range of the Fox and Franz Josef. From this pass, which we named Blackburne's saddle, we saw, leading straight up to the divide, a kind of arête, which we thought we could manage, even though covered with the newly fallen snow of the previous evening, if we were unable to find what we hoped, namely, an easy snow-slope leading from the head of the Fritz glacier directly over to the Franz Josef between Mount Roon and Mount Anderegg. We therefore at once started for this Blackburne's saddle, to which we mounted without much step-cutting, as the fresh snow had frozen and we could trust ourselves to it. At 7.30 we reached this pass, after crossing some very nasty crevasses. The sun had now risen, and we were confronted with a most glorious view. The west side of Mount Tasman showed itself to us in great perfection, with its rock precipices rising some 6000 feet out of the head of the Fox glacier. Behind us the Fritz glacier, almost on a level with our saddle, flowed down towards the sea. We were the first to explore the head of this glacier.

We now proceeded to follow up the rock arête that led towards the divide. After following it for a little, we cut off to our left, and began to mount the Fritz glacier, which, as we anticipated, led by an easy slope to a snow saddle eventually christened Zurbriggen's saddle. All went smoothly for a while until a huge crevasse seemed to cut off our advance from every side, and as clouds now began to gather, fearing lest we should not be able to reach a point from which it would be possible to see a route across the head of the Franz Josef,

we turned back to our ridge, knowing that from it, by patient climbing, the saddle we had in view was attainable. We hastened on, and at about half-past ten reached Zurbriggen's saddle, some 7160 feet above sea-level, as I made it out. Here a sort of snow dome cut off our view; so, proceeding round this, at eleven o'clock we reached a ridge between the Blumenthal and Melchior glaciers, from which we got a most magnificent panorama of the huge basin at the head of the Franz Josef glacier, with the great peaks of Elie de Beaumont, De la Beche, the Minarets, Glacier peak, and many others standing out in the clear atmosphere as if quite close, though in reality several miles away. The chief



GRAHAM'S SADDLE, FROM THE EYRE GLACIER.

object, however, that attracted our attention was a huge precipice at our feet with no visible way down it. To pass around it would have involved descending the almost impossible icefall of the Blumenthal glacier, an operation that would have taken at least six or seven hours, and thus forced us to camp for the night on the ice. The rocks on either side seemed absolutely sheer, and we seemed doomed to have to take recourse to some desperate remedy, when Zurbriggen, who had untied himself from the rope and had been searching about for some way down, shouted to us to come to him, apparently at some impossible place under our feet. After a little difficulty we reached him, and found that he had discovered a couloir or small gully filled with ice, which he thought "would do." By mid-day we had passed the worst of it, and were able to get upon the Anderegg glacier, after crossing some tremendous crevasses. We cut straight across this glacier to a ridge separating it from the Agassiz glacier. We crossed the whole of the latter, and soon reached a glacier

which flows down from what is known as Graham's saddle. This we called the Eyre glacier.

We were so thirsty by this time that we could no longer endure our suffering, and stopped to see if it were not possible to melt some snow on a bit of black mackintosh sheeting which we still had left to us, thinking that the sun, being attracted by the black, would heat it and thus liquefy the snow. At the same time, with the help of an old treacle-tin and an old candle that we cut into half a dozen pieces, we improvised a species of "Etna," and melted about a cupful of water mingled with lumps of treacle. These operations lasted nearly an hour, and we were conscious that every moment was precious if we wished to get off the glacier before nightfall, but our thirst was such that we did not care what happened so long as we obtained a few drops of water.

It was not before six o'clock that we were again under way, and by about a quarter-past six we stood upon Graham's saddle, the dividing-line between Westland and Canterbury, and looked down into the familiar Tasman valley. Descending and climbing on to the rocks of De la Beche, we took off the rope that we had worn on the glacier, and rushed down over the loose rocks, hoping to reach the Rudolf glacier before the light should fall. We were nearly down, when Zurbriggen fell and sprained his ankle, so that it was painful for him to walk. It was growing dark, and we had to light our lanterns, trying thus to get down the last few hundred feet; but Zurbriggen fell again, this time through a crust of snow bridging over a little stream, and so hurt the other ankle that he was nearly crippled. The rope had again to be put on, for the rocks were steep and glazed with ice. A hundred feet only intervened between us and the Bergschrund, which separated us from the Rudolf glacier, which we knew meant comparative safety and comfort; but now Zurbriggen hurt his ankle for a third time, while all the photographs, sketches, and notes that I had taken since the ascent of Mount Sefton dropped out of Harper's knapsack and whizzed past me into the Bergschrund. I made one frantic effort to snatch them, nearly losing my footing and rolling down after them in the attempt. I saw that there was nothing for it but to spend the night out here on the ice-covered rocks; so calling back Zurbriggen, who was trying to get down the absolutely sheer glazed rocks, we retraced our steps some 50 feet, to what seemed the most suitable place to spend the night. This was a ledge about 4 feet long and 18 inches broad, on which the three of us could just manage to sit. No sooner had we settled ourselves here than I heard the whiz of falling stones. This was the commencement of a cannonade that was kept up at intervals throughout the night. Sometimes rocks flew past us so near that we almost felt the wind from them. We never dared so much as to close an eye all night, for fear of slipping off into the abyss below. The cold became intense, the thermometer dropped to 25°, and, as most of our garments had been soaked in

wading through the melting snow during the day, our things froze hard.

With the dawn we were preparing for departure, but everything was frozen stiff. Our rope was like an iron bar, and our clothes would not give to our motion at all. Harper's boots were frozen so tight that he had to cut them open, and burn innumerable candles inside before he could get them on. We crept slowly down the rocks, and found that we were much nearer the glacier than we had supposed; also that that we had taken for a crevasse was nothing more than a heap of stones. In ten minutes we reached the glacier, where I found my photographs and papers, which had been caught up in their downward course by a projecting ledge of ice, and thus saved from a deep hole leading down to some water, into which had they fallen they would certainly have been lost for ever. We were very stiff, and could scarcely walk at all, but the sun soon thawed us, and at 10 a.m. we reached the Ball hut, where we were detained nearly a week by torrential rain. Thus ended our journey back from the west coast. In returning we had crossed ten of the great glaciers of New Zealand in three days, including the three biggest—the Tasman, the Fox, and the Franz Josef.

In conclusion, I will say that, owing to the nature of the climate and the impossibility of getting porterage, explorations in the Southern Alps of New Zealand are attended with many hardships, and, from the fact that there is no really reliable map of the glaciers, if a traveller is caught in certain places with fogs and mist, it would be almost impracticable for him to extricate himself with an aneroid and compass, as Sir Martin Conway proved it possible to do in the European Alps, when he performed his journey of 'The Alps from End to End,' on which expedition I was so fortunate as to be with him, and to learn the practical application of his method.

Before the reading of the paper, the President said: Our attention this evening will be turned to the Southern Alps of New Zealand. This Society has, during the last fifty years, received various communications regarding that splendid range which Captain Cook called the Southern Alps. I think it is nearly fifty years ago since Mr. Brunner made explorations in the northern part of the west coast, and sent home a very full paper, which induced our Council to present him with one of our awards, as a recognition of his valuable geographical services. We have also received a description of their appearance from the west coast, from Captain Stokes, of H.M.S. *Acheron*, after whom one of the peaks is named; but I think the first traveller and explorer who actually reached the glaciers was Dr. Haast, and his companion Dr. Sinclair, who was carried away to his death by one of those glacial streams, the first martyr to science in New Zealand. I am sure all those who are present will remember with pleasure the charming and interesting paper read by Mr. Green a dozen years ago on the ascent of Mount Cook, the highest peak of that range, supposed, before his ascent, to be inaccessible. I am glad to be able to tell you that he is present this evening. Our last communication was

from Mr. Harper, the young secretary of the New Zealand Alpine Society, who treated of the glaciers in a general way, which have been carefully described to us on more than one previous occasion. Now I believe we are to hear not only of the glaciers, but also of the discovery of the first, and probably the only practicable pass across that formidable snowy range of mountains. I will now call on Mr. Fitz Gerald to read his paper.

After the reading of the paper, the following discussion took place:—

Sir Westby Brook Perceval, Agent-General for New Zealand: I have only got one fault to find with our President, and that is, he gave me no notice of the demand which he has just made, that I should say a few words on the paper we have just listened to. However, I think it would be extremely ungracious on my part if I did not accord to Mr. Fitz Gerald my thanks, and, I think I may add, the thanks of the colony of New Zealand, for the very valuable services rendered to us, in the discovery of a mountain pass for tourist and other traffic. You have gained from the beautiful slides some idea of our scenery. We look upon our scenery in New Zealand as one of our most valuable assets. It is so in more senses than one. It is owing to the snow-ranges that the country of New Zealand possesses such an ample rainfall, and such a fertile soil. I almost regret that our empire possesses so few glaciers and snowclad ranges. I think, if we could put a snowy range down the centre of Africa we should do a very fine work. I thank Mr. Fitz Gerald most sincerely for his paper, and am extremely glad to have been present to-night to hear it.

Rev. W. S. Green: It is with the greatest possible pleasure I have come here to-night to realize a dream of my own of fourteen years ago, when I was in the New Zealand Alps. For the last twelve or thirteen years I have taken a great interest in the explorations carried on by New Zealanders themselves, who have pressed on in a most marvellous way. Considering the population of the country, that population has produced a large number of climbers, and they have worked assiduously there ever since; but certainly Mr. Fitz Gerald's work has been like the reaping of the harvest. Even as the harvest is greater than the seed-time, so his work is the greatest done in that country. He passed over very lightly the difficulties of that terrible passage down the Copland valley, which I can appreciate, from having had to force my way through scrub and take our packs through it before the track was cut which now exists to the foot of Mount Cook. There must have been a great deal more of it down the Copland valley, in those deep cañons lined with bush, and with nothing but a smoke of tobacco to carry him along. These three days represent much more than he has given us any idea of. When I went out, we had some little difficulty in getting at Mount Cook at all, and when we did, only reached the top at half-past six in the evening, and, to save our lives, left the last little bit unascended. I was very sorry afterwards I did not push on. I think if we had we should have reached it; but we had gone for twenty-two hours without any food, and between that and the unpleasantness of being on the top of a mountain at night, we turned down. I was sorry at leaving that little bit undone; but I have had reason to be glad ever since. It has stimulated the New Zealand Alpine Club to the most superhuman exertions to manage that piece, and the result has been that they got up this year, Mr. Graham, Mr. Fyfe, and Mr. Clarke, by an entirely new route, and reached the summit. I consider that if I had done that little bit which I left undone, I should have taken away a great incentive to Alpine climbing in New Zealand.

On looking at this map which has been put into our hands, I see one thing which is particularly interesting. When I read my paper a long time ago, I remember speaking of some of these glaciers coming down close to the sea, which is a

remarkable fact, the Fox glacier coming down to within 600 feet of the sea—so far as I am aware, lower than any other surveyed. When I spoke of that here, Mr. Freshfield said, "The probability is, that the basin must be extraordinarily large." Now, if we look at the map, we see the nevé basin is very large. The supply of ice is enormous, enabling the glacier to reach far down. The immense rainfall in the Southern Alps keeps up the supply of ice. It has been to me a very great pleasure indeed to hear Mr. Fitz Gerald read his paper to-night, and the only way I can show this is to say that I left Dublin this morning in order to be present to hear it.

Sir W. Martin Conway: I have never been in New Zealand, and I am afraid any remarks I might make about the country and its mountains would be wide of the mark, I was very much struck by the admirable photographs which Mr. Fitz Gerald has taken, and which I regard with envy. They were taken with the same camera that I had in the Himalayas, and which in my hands performed a remarkable journey, viz. falling down a hillside for half a mile, and being dinged into holes, so that when I took a photograph it was like playing on a flute, so many were the holes to be stopped by fingers. I remember the photographs I was able to take, and, comparing them with these, I regard these with fully as much envy as admiration. In looking at these views, what occurred to me was that the New Zealand Alps in their snowy mantles are different from any other mountains I know, entirely different to the snow covering of the Alps. If anybody who is familiar with the Alps were to see these photographs, he would know at once that he was in the presence of an entirely different kind of mountain, because all the snow-slopes we have seen, all the glaciers, are as it were laden and overborne with snow. The glaciers bulge over and force their way down with an energy you do not see working in Alpine or Himalayan glaciers. That weight on the glaciers, overburdened by snowfalls, brings the Fox glacier down to within 600 feet of the sea, the unusual snowfall doubtless corresponding with the great rainfall of 150 inches in the plains below. This creates a new set of conditions for the mountaineer, and for Mr. Fitz Gerald to be transported into these new conditions, and to carry through a journey of such importance and achievement as he has done without misfortune and accident, is a very great proof of his ability as an explorer. Indeed, I would go further, and say that it has occurred to me, as Mr. Fitz Gerald read his admirable paper, and showed his excellent slides, illustrating what he has done, that possibly we were brought to-night into the presence of the man who is to be identified with the greatest remaining unexplored region of the world outside of the polar regions. For, leaving the polar regions out of account, the only great and important parts of the world unexplored are the mountain ranges. They are barely touched, and it remains for the coming generation to bring them into the area of the known. When we see before us a gentleman, who (I think I violate no confidence when I say it) is probably young, and who has shown such extraordinary ability as he has, in dealing with mountain-exploration, I think we may foresee in him one of whom we shall hear more in the future.

Mr. Claude L. Barrow: It is with some hesitation that I undertake to speak before such an audience as the one before me, but I feel, to some extent, justified by the fact that I was with Mr. Fitz Gerald throughout his stay in New Zealand, and I had then every opportunity of observing and admiring his methods of exploration, and the great patience he showed in the face of obstacles which, I think, might well have deterred many a more experienced explorer. I, for one, can testify to his unfailing cheerfulness and resolution in the long rainy weeks we spent together in our little camp outside the Hermitage. One of the great difficulties Mr. Fitz Gerald experienced was that of the transport of provisions. It is almost impossible, in

fact I may say it *is* impossible, to get any one in New Zealand to act as porter upon the glaciers. Mr. Fitz Gerald solved the problem by not carrying any provisions at all, as you will have heard in his paper to-night. This was a ready way out of the difficulty, but one which, I think you will admit, few would care to try. During my stay at the Hermitage I had a chance of observing the infinite variety of plants and animals of these regions. The flora is really very beautiful, combining to a certain extent what we are accustomed to think of as alpine with the richer vegetation of the lower regions, and I am sure that there is a great field here for botanists. The birds, too, are wonderful, especially the kea parrots. The intelligence of these birds is quite extraordinary; their curiosity is easily roused by any strange object, and whenever anything puzzles them, they seem to hold a sort of informal meeting, one standing in the centre and haranguing his fellows. Their loud jabber is very amusing; one feels that it would be almost possible to get to understand their language. They are a very ill-tempered bird. We put two into a box with a partition between them; they broke through this and killed one another—the partition, I suppose, preventing them from meeting with the fate of the Kilkenny cats. Meantime many of their friends had assembled from the whole surrounding neighbourhood, and their persistent efforts, day and night, to liberate the prisoners were rather touching, but very noisy. I am not aware that the nest of the kea parrot has ever actually been seen. I must not omit this chance of expressing the great admiration which I felt for Mr. Fitz Gerald's Swiss guide, Zurbriggen, throughout this expedition. He is a man who seems, in every way, worthy of the high esteem felt for him by all those who have ever employed him. Altogether, I congratulate Mr. Fitz Gerald on the success of his expedition, and, as myself a witness of the hardships he had to endure and the obstacles he had to surmount, I think I may say that this success was very fairly earned.

The PRESIDENT: It only remains for us to thank Mr. Fitz Gerald, who has performed a great and important public service in discovering this, probably the only pass through the great snow range of New Zealand, and who has enhanced the interest of these surveys by the resolute way in which he has faced and overcome extraordinary difficulties. I am sure you will all pass a very cordial vote of thanks to Mr. Fitz Gerald for having told us so admirably the story of his expedition, and for having illustrated it with so many interesting views. I call on you to pass this vote of thanks unanimously, and to allow me to thank Mr. Fitz Gerald for his paper.

CRUISE OF THE "BALÆNA" AND THE "ACTIVE" IN THE ANTARCTIC SEAS, 1892-93.

I. THE "BALÆNA."

By WILLIAM S. BRUCE.

WITH the exception of a flying visit made in 1874 by the *Challenger*, the Antarctic Regions had up to 1892 been entirely neglected since Ross's expedition of 1843, and well-nigh forgotten. An accident of commerce then led to a slight revival of scientific interest. A fleet of four whalers set out in September, 1892, from Dundee to search the Antarctic seas for the bowhead (*Balæna mysticetus*), or some similar whale. The fleet consisted of the *Balæna*, in which I sailed as naturalist, the *Active*, the

Diana, and the *Polar Star*. Our vessels, after a voyage which was prolonged to thirty or forty days beyond the calculated time, and during which the chief fact of much interest was the complete failure of the north-east trade winds, met at the southern ice in Erebus and Terror gulf. There we found an earlier arrival, the Norwegian sealing vessel *Jason* (Captain Larsen), the ship in which Nansen set out from Iceland for his famous crossing of Greenland. The *Jason* was strictly on commerce bound, though the spirit of the great explorer who had sailed in her earlier had in some measure descended on Captain Larsen, for, without any special resources, he showed a zeal for extending our knowledge of these regions that would not have been unworthy of the leader of a purely scientific expedition. A scientific department had been attached to the Dundee whalers. With the consent of the owners and masters, the Royal Geographical Society spent over £150 in equipping these four vessels with instruments for geographical observation. The Meteorological Office provided a complete set of meteorological instruments. Mr. Leigh Smith, who has done so much to enlarge our knowledge of the Arctic regions, extended his exploring interest to the Antarctic by adding to the *Balæna's* equipment a handsome outfit of biological apparatus, a deep-sea thermometer, etc., for my use. Professor Haddon contributed two deep-sea thermometers, and Dr. H. R. Mill a pocket-aneroid and a spectroscope. The *Active*, the *Diana*, and the *Polar Star* were supplied by Professor D'Arcy Thompson with a zoological outfit, while he drew up a series of careful directions to guide us all in the collecting and preserving of natural history specimens. I take this opportunity of thanking these gentlemen and many others not named for their support. Dr. Mill especially was untiring in his endeavours to make the expedition a scientific success; for, besides the valuable personal contributions mentioned above, he drew up, on behalf of the R.G.S., a valuable set of instructions for the naturalists, and of suggestions for the captains who were now to sail for southern seas for the first time. I have to thank Professors James Geikie, D'Arcy Thompson, Dr. John Murray, and Mr. Robert Irvine for their valuable appendices to this paper. Mr. Andrew J. Herbertson has given me many valuable suggestions in compiling the tables; and Mr. William C. Spence's help has been invaluable to me in drawing up this report.

We sailed on September 6, 1892, and the *Balæna* first saw ice, in the afternoon of December 16, about 59° 40′ S. and 51° 17′ W. The same night about ten o'clock we sighted our second berg. From this point I give a brief journal of the voyage for the few days until we finally settled down to look for whales among the ice.

December 16.—Position at noon, 59° 24′ S., 51° 1′ W. (by observation). The weather was fine and bright in the earlier part of the day, becoming overcast and rainy in the afternoon and evening. The wind was westerly, backing a little in the afternoon, varying from a gentle

to a moderate breeze. The barometer fell steadily from 29·834 inches at 6 a.m. to 29·515 at 8 p.m. The sea was smooth to slight. All day we were surrounded by myriads of birds, mostly cape pigeons, among them being thousands of blue petrel and smaller numbers of mollyhawk. On the water surface, from quite near to the ship to far on the horizon, we could see thousands of the finner or blue whale, blowing the water into fountain-like spouts, and filling the air with their characteristic note of booming resonance.

December 17.—Position at noon, 61° 6′ S. and 52° 3′ W. (by account). The weather was foggy all day, with the temperature falling throughout the day from 33·7° to 29·8° Fahr. The wind was light and varying from the west. The barometer was fairly steady, rising slightly after 8 a.m. The sea was smooth. The same day I was called on deck to see, as I was told, some small seals. They were swimming with rounded backs just below water, and only the head above it. What the sailors took for seals were really penguins, with their silky, hairlike feathers looking like wet fur. The sailor refuses to recognize feathers in this close-fitting fleece, black on the back and white on the breast. We met with drift ice and a few bergs, both small and great. To-day we saw and shot our first seal, a sea-leopard (*Stenorhynchus leptonyx*), one of the largest kinds, as it drifted past us asleep. The lead was cast, with 100 fathoms no bottom.

December 18.—Position at noon, 61° 44′ S. and 52° 18′ W. (by account). Rainy and foggy weather, with a uniform temperature a little above freezing. A light wind in the morning rose in the evening to a moderate gale, accompanied by squalls; it veered round from E. by S. at 8 a.m. to W. at 4 p.m., and backed in the evening to W.S.W. The barometer fell slightly till noon, rising again towards the evening. We passed a great many large bergs and much broken ice. The bergs were mostly tabular, with a few other shapes. There were a few birds of the kinds already mentioned.

December 19.—Position at noon, 62° 12′ S. and 52° 13′ W. (by observation). The fog rose suddenly at 8 a.m., revealing a bright sun; the sky was cloudy, and became quite overcast by evening; the temperature remained practically uniform, about a degree above freezing. The wind backed from N.W. by N. to N.N.E., rising from a light breeze at 8 a.m. to a fresh gale at 8.30 p.m. The barometer fell considerably in the course of the day. The sea was slight, with a northerly swell. When the fog lifted we found ourselves surrounded by icebergs, the resounding murmur of which had been reaching us through it. One berg of 10 miles' length, by bearings, that we saw yesterday, we found now considerably broken up by the swell. To-day we saw the largest berg the *Balæna* met; it was 30 miles long. At noon we came on a great body of ice, which, according to the skipper, was the main pack. There was an icy sky towards the South Orkneys

to the north-east. Hitherto we had been pursuing a more or less southerly course, but now headed in an almost westerly direction.

December 20.—Position at noon, 62° 18′ S. and 53° 45′ W. (by account). Very foggy; with same temperature as yesterday. The wind was light all day, veering from N.W. by N. at 6.30 a.m. to W. by S. at noon, and backing to W. by N. by 8 p.m. The barometer rose from 28·805 at 6.30 a.m. to 28·951 at 8 p.m. The sea was smooth, with a heavy cross swell from N.W. by N. and N.E. by N., and at 4 p.m. very heavy from N.W. by W. Soundings were got in 161 fathoms, and the bottom temperature was 29·8° Fahr., the surface temperature being 30·3° Fahr. We met many bergs and much broken berg ice. During the day we saw cape pigeons and petrels, blue, stormy, and white. The last Ross found to indicate proximity to the main pack.

December 21.—Position at noon 62° 21′ S. and 54° 3′ W. (by account). The fog still continued thick, becoming clearer at 3 p.m., but soon coming down again as thick as ever. The temperature was a degree lower than the last two days, except at midday, when it rose to 34·2° Fahr. Moderate wind, backing from N.W. by N. at 9 a.m. to N.E. by E. at midnight. The barometer continued to rise until 8 p.m., standing then at 29·045, and then fell again. The sea was still smooth, with N.W. swell, which became slighter to midday; and in the afternoon a slight N.E. swell. The colour of the water after 8 p.m. was a dirty green. A number of soundings gave depths from 139 to 170 fathoms. We were still amongst bergs. Besides the birds of yesterday, we saw a sheathbill and some terns; there were many whales, none resembling the bow-head, and also some seals.

December 22.—Position at noon, 63° 2′ S. and 54° 31′ W. (by observation). The weather was foggy and overcast with fine snow; the temperature varied between 29·9° Fahr. and 31·9° Fahr. A light wind backed from N.E. by E. to S.S.W. from 2 a.m. to 10 p.m. It is notable that, in spite of this change of wind, the fog, as stated above, still continued. The barometer was unsteady in the morning, but during the afternoon it rose, till at midnight it stood at 29·097. The sea was still smooth, with a slight N.W. by N. swell, and the water of a dirty green colour. Soundings in the afternoon gave 235 fathoms, the bottom temperature being 28·6° Fahr., and surface 30·9° Fahr. Soundings at 8 p.m. gave 175 fathoms, with a bottom temperature of 29·5° Fahr.; at 50 fathoms, of 29·7° Fahr.; and at surface, 29·7° Fahr. Still the same birds and whales.

December 23.—Position at noon, 63° 24′ S. and 54° 11′ W. (by observation). The weather was at first hazy and overcast, and then became brighter, though cloudy; a slight snow-shower at 8 a.m.; the temperature remained as yesterday. The wind was light and variable, W. by S. to S.E. by S. The barometer rose to 29·264 at 10 p.m. The sea varied from slight to calm, and the water from being inky became a

dirty brown. This latter colour, like the snowy petrel, of which we saw some to-day, Ross had noted as an indication of proximity to the main pack. When to the south-east of Danger islands we passed great chains of bergs and great quantities of pack ice, having sighted Joinville Land and the islands in the early morning. We passed a good many seals, and for the first time saw the white seals (*Stenorhynchus carcinophaga*). We still had the birds before mentioned.

December 24.—Position at noon, 64° 13′ S. and 55° 52′ W. (by observation). This is the exact point which Ross reached on New Year's Day, 1843, and there is no record that any one did so before, or has done so since, till Christmas Eve, 1892. We fastened to a large floe, on the look-out for the whales reported by Ross. We were within 12 miles from Cape Seymour, and Mount Haddington was visible further to the west. The weather to-day was fine and bright, a cloudy sky being at times broken by brilliant sunshine; morning and evening there were slight snow-showers. The temperature varied from 29·3° Fahr. to 32°. Light wind, chiefly from S. by W., being more variable in the afternoon. The barometer rose all day to 29·482 inches at midnight. The sea was very smooth, and in the evening calm. To-day we first marked down a current, which was S.S.E. Soundings at 8 p.m. gave 194 fathoms, Ross having there registered 200. Bottom temperature, 28·6° Fahr.; at 100 fathoms, 29·2° Fahr.; at 50 fathoms, 29·3° Fahr.; and at surface, 32° Fahr. The water was olive-brown in colour, as well as the water-washed parts of the pack and the bergs. The bergs were large, numerous, and tabular. One weatherworn berg had masses of rock and soil on it, but, the harpooners thinking it dangerous, I was not allowed to secure any specimen of this rock and soil. We captured some seals, and, though we saw many whales and grampuses, we saw no whale resembling the bowhead. All the previously named birds were present, and we shot and secured for the first time the sheathbill and the emperor penguin. At midnight it was a perfect calm, as the *Active*, the *Diana*, and the *Balæna* lay fastened to the floe—the *Polar Star* not having yet joined us. I took several photographs of our surroundings at midnight, but no photography could give a hint of the light and colour of this Antarctic midnight. Never have I witnessed such excellent delicacy of colour. Though the sky was grey, the ice the whitest of the whites, and the sea in contrast blackness itself, yet rosy hues, purples, soft blues, translucent greens, and yellows shed their coloured mantle of light upon the whole; different indeed from the tropics, where colours are infinite and brilliant, yet often perhaps too crude.

December 25.—Position at noon, 64° 23′ S. and 56° 14′ W. (by observation). We remained fast all day to the floe, in fine weather with very slight showers of fine snow in the early morning. The temperature varied more than usual, ranging from 29·4° Fahr. to 35° Fahr.

There were light airs from E. to S. till early afternoon, and a calm after. The barometer went on rising, reaching 29·704 inches at 6 p.m. The calm sea was still of the brown colour. Soundings were obtained at 8 p.m. in mud at 200 fathoms, again confirming Ross. The bottom temperature was 28·9° Fahr.; at 120 fathoms, 28·8° Fahr.; at 60, 29·2° Fahr.; and at surface, 31·8° Fahr. There were remarkably few appearances of animal life.

This day ends the regular and accurate record of positions, till it was resumed on February 18 on our leaving the ice.* The whole ship's attention was given to the search for the expected whale, north, east, south, and west of Ross's 1843 position, varied with the catching of about 1000 seals. This went on to January 12, when hopes were finally given up of getting whales. So far as it goes, this search failed to confirm Ross's statement as to the existence of the black whale in these waters, though a contradiction of the statement would not, in my opinion, be justified till a search be made more extensive, both in space and in time, than was undertaken on this occasion. Whales there were, as already stated, but whales of the finner tribe, which require very different ships and tackle to those we were supplied with. Were vessels and tackle such as are used off the Norwegian coasts despatched to the Antarctic, I am confident that the blue whale fishery could be prosecuted with great success.

Day after day followed, till February 18, with the same tasks, namely, bringing seals on board and "making them off." I was usually out with one of the boats, but sometimes remained on board, and then often at the wheel. On these occasions meteorological observations suffered, but during gales, when all hands were usually on board, fairly copious notes were taken.

The scientific work of the expedition was not done in very favourable circumstances; commerce was the dominating note. A great deal more might have been done for the geology and the biology of these Antarctic Regions if some opportunities for landing had been afforded me. So early as December 26 I had the misfortune to lose the bucket for taking samples of surface water, and, as it was never replaced, observations for salinity were completely stopped after that date; and as for temperatures, they were only got under such imperfect conditions as lowering the thermometer over the ship's side when she was quite still.

The following notes contain observations between December 16, 1892, and February 18, 1893.

Land.—The *Balæna* was never within less than 6 miles of land. What we saw of it from that distance was entirely snow-clad, except on

* The Dundee vessels cruised during the two months between 60° and 65° south and 51° and 57° west; that is to say, within an area measuring 300 by 180 miles.

the face of precipitous slopes, where snow could not lie. These uncovered parts appeared quite black, and, so far as could be judged in the circumstances, were of igneous origin.

A few rocks secured from a piece of ice and from the stomachs of penguins bear this out, for Professor James Geikie informs me that a rough examination of them shows them to be mostly of igneous origin. The two largest specimens, he says, are olivine. The smaller ones will need a more careful examination, but among them he recognizes basalt, basalt lava, and possibly gabbro. Dr. Murray, however, finds evidence of continental rocks in some bottom samples I secured. I regret that I was unable to bring more rock specimens, several of the largest having been heaved overboard by some unknown member of the crew. I believe these latter were also olivine.

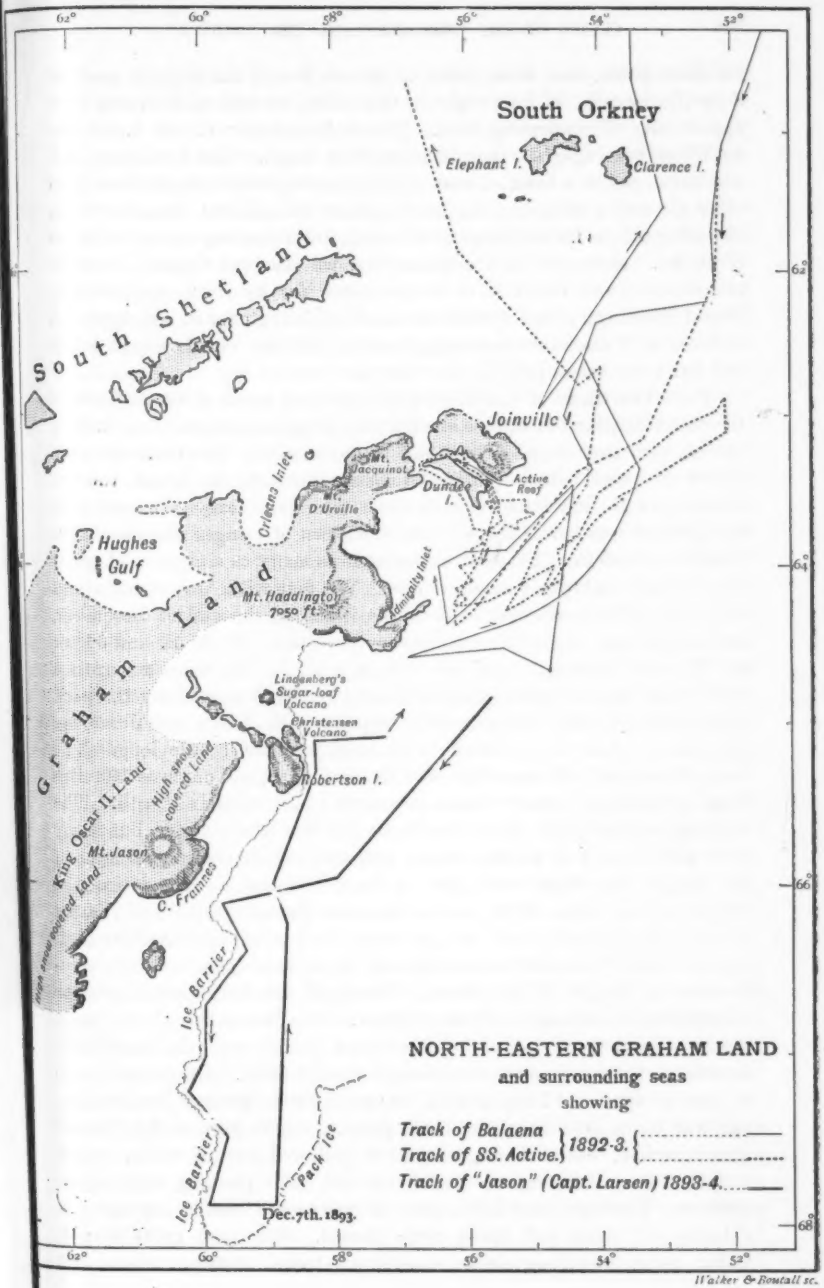
On several occasions I saw rocks and soil on the ice and on bergs, and once we passed a very stratified earthy piece of ice, but I was not allowed to procure specimens.

As to the geographical distribution of land, the *Balæna* made no important discoveries. The small islands in the northern portion of Erebus and Terror gulf were thought to be somewhat inaccurately charted, but no correction was made. On January 12 we were in *about* lat. 64° 35′ S., long. 56° 52′ W., and saw what appeared to be high mountainous land * and glaciers at a distance of 60 miles, stretching from a point about 64° 25′ S. and 59° 10′ W. to about 65° 30′ S. and 58° W. Captain Fairweather said definitely that this was land, and has marked it in his chart as such. I should rather be inclined to call it, in Ross's words, "an appearance of land," for, although it certainly looked like it, and I believe may have been the east coast of Graham's Land, yet one must remember how often Ross sailed over what he believed to be certain land, and how others have mapped out regions which never existed.

It is extremely regrettable that no effort has been made to approach this supposed land, and, if it really existed, to map it out accurately. This seemed to me quite possible, for by all appearances there was no very compact ice in that direction; certainly we could have got much nearer than we did. But back to the seals and blubber was the *mot d'ordre*.

Ross ('Antarctic Voyages,' ii. 324) calls the attention of future explorers to the belief of Captain Crozier and his officers, that they saw smoke issuing from a certain mountain; what mountain, however, Ross does not very clearly particularize. This phenomenon had not been observed by any one on the *Erebus*, but he thinks it may have accidentally escaped notice there. Captain Crozier's observations he attributes to wreaths of snow or mist whirling round the hilltops. I believe, from

* Captain Larsen (1893–4) confirmed and extended his own and our discovery in the following season by mapping out the eastern coast of Graham's Land to about 68° south.



Walker & Boutall sc.

his description, that Ross refers to Mount Percy, the highest peak of Joinville island. If I am right in this belief, we had on February 6 an opportunity of confirming Ross. The *Balæna* was in 62° 58′ S. and 54° 45′ W. by bearings, less than 20 miles from shore. The low-lying land was enveloped in a bank of mist, but the peaks shone forth brilliantly in clear air and a cloudless sky, and neither from Mount Percy nor from any other hill, as far as the eye could reach, did we see any sign of an issue of smoke. Moreover, on Christmas Day we observed Captain Crozier's phenomenon, and found it to be accounted for by Ross's explanation. Mount Haddington had wreaths of clouds whirling over it, and appeared at times as if smoke were issuing from it; but the clouds swept away and left a smokeless peak in the clear air.

Ice.—The whole of the district we traversed south of the latitude of the South Shetland islands is strewn with bergs, and south of 62° S. they become very numerous. There was no day in which there was not some record of bergs being seen, but in some districts we found the sea much more thickly studded with them than in others. We met with the greatest number of bergs to the south-east of Danger islands, where I have counted from the deck at one time as many as sixty-five of great size, to say nothing of smaller ones. We met with very many about 60 to 100 miles north-east of Joinville island at the end of December, and also at the beginning of January, in about 64° 30′ S. and 54° or 55° W. On January 11, in 64° 32′ S. and 55° 25′ W., we came across a row of ten bergs of great length running east and west along the pack edge. On February 10, when in company with *Diana* and *Jason*, we saw many great bergs, one 4 miles long, another 1 mile long. The longest we met with was fully 30 miles in length, and one was 10 miles long by bearings. Many others measured 1 to 4 miles in length. The highest berg recorded by us was about 250 feet above water, but many were not over 70 or 80 feet high; I should say the height of most of the bergs was about 150 feet. I have recorded a berg twice the height of the *Jason* lying a considerable distance S.S.W. of Paulet island. On January 1, off Danger islets, there were bergs half as high again as the *Diana* and the *Active*, and in the same place a berg three-fourths the height of the *Diana*. Nearly all the bergs are tabular or weather-worn varieties of the tabular. On December 18 we came across several more varied in shape than usual; one was beautifully conical, and one had very well-marked stratification. On December 20 we saw a castellated berg, looking like part of some strange fortification; one was hewn into beautiful Doric pillars; others were in the form of grand arches; others had great caves hollowed out of them, which in some cases were connected with vertical holes piercing their upper surface. Through these holes, when a heavy swell beat up the caverns, columns of water and spray were ejected, often to a great height. Other bergs overhung their water-worn bases. Strange cracks and

fissures abounded. The whole face of a long berg sometimes exhibited a row of perpendicular fissures, the walls of which were bowed out. On several occasions, notably on December 18 and 20, I saw bergs which were fringed with pale brown along their upper edge, and sometimes with pale brown streaks, like a vein, apparently sandwiched in their main mass. This, I believe, has not been before noted. Ross mentions the base of bergs and pack-ice being coloured brown by organisms that exist very abundantly in the water, which our observations also confirmed. But this new observation refers to the top of the bergs, at a height of perhaps 150 to 200 feet above sea-level; and that, too, in bergs that had never been overturned. The tops being inaccessible, we got no specimen.

Apart from these very occasional streakings, the bergs are white. There is a complete absence of tints, except for the infinitely varied play of the light. In the fissures one gets the most magnificent blue, a blue which Mr. Burn Murdoch, the artist of our *Balæna* company, thinks resembles cobalt. But it cannot be described, and no palette has resources to paint it. Those who wish to appreciate its purity and intensity must see it for themselves. Similarly, there are brilliant splashes of emerald green, with an infinite number of other shades. Many of the overturned pieces of some broken-up berg look like huge masses of sulphate of iron that have undergone some oxidation. Although on many dark nights we were surrounded by bergs, in no case did I observe any such phenomenon as a luminous glow on them, as Dr. John Murray has noted.* But I have, I believe, observed a luminous glow from the pack-ice.

The pack-ice of these regions was said on the *Balæna* not to be heavier than in the north, if it were as heavy. It is also similar in nature. Therefore I need not describe it here. The conglomeration of pack and broken pieces of bergs is also similar to that of the north. One must note, however, how frequently it is coloured brown by the diatoms, *Corethron criophyllum* and others, which swarm in the water near the main pack.

We first met the dense pack-ice on December 19, in lat. 62° 20′ S., 52° 20′ W., the edge of which lay in a more or less easterly and westerly direction, and the sky seemed, too, to indicate ice towards the South Orkneys; but, by steering a more westerly course than we had been doing, we avoided it, as it appeared to trend in a southerly direction in about 53° 20′ W. On December 24, in 64° 13′ S. and 55° 51′ W., we fastened to the edge of a great floe, the end of which could be seen only at the masthead. On January 11 we ran east and west along the pack edge, which lay in about 64° 37′ S., our position at noon being 64° 33′ S. and 55° 25′ W.; but on January 12 we saw fairly open water

* The *Scottish Geographical Magazine*, vol. ii. p. 534.

to the south-west. The pack edge was seen, besides on the above dates, on the 5th, 7th, 19th, 20th, and 21st of January; but I cannot define the ship's position quite satisfactorily for these last-named dates, and I am therefore unable to say how and where the pack edge was, except on December 19 and January 11. The *Balæna's* work lay almost entirely between about latitudes 64° 30′ S. and 62° 30′ S., and longitudes 53° W. and 56° W. We never entered the main pack, except on one occasion at its extreme edge. In this region we only met with scattered pack-ice or with streams of pack-ice, which were sometimes very heavy. In February there was a considerable amount of pack-ice in Erebus and Terror gulf.

Red snow was reported to me on one occasion; but I rather suspect, from the description I had given me, that the colour was due to the blood of a slaughtered seal, which had soaked through the snow.

Sea.—The colour of the sea in those parts varies very much. Now it is blue and clear, now olive-brown and opaque; and between these two colours there is a series of shades from greenish blue, dark green, and olive green, and of transparency from clearness to opaqueness. The browner water seems to be in the neighbourhood of a great body of ice; we noted it at Christmas-time, coming into it first on December 23, and emerging from it on December 27, both north and south of Ross's 1843 position; and again we met it on the 10th, 11th, and 12th of January, in a second attempt to get south-west. For the rest of the time we found the water mostly blue, or very nearly so. The olive-brown colour is due to the *Corethron* diatom, which swarms, as we have said, in great quantities in these waters, and colours the pack-ice. It abounds on every shelf below the surface of the water, and in the holes of the honeycombed ice. The bases of bergs are coloured by it. The bluest water we found most profitable to hunt for seals in. After December 26, for reasons already stated, salinities were beyond my reach; but I was still able to take advantage of a few occasions of ascertaining deep-sea temperatures. The table of temperatures must be read with regard to these conditions. The deep-sea thermometers were left down for about two or three minutes before they were inverted; in no case were they left down for less than two minutes, and I should have preferred that the instrument should have been left down longer. It is, perhaps, of interest to remark that the reversing frame and Negretti and Zambra's thermometer had never before been used in this part of the globe, and it is a great pity I had no opportunities to use it oftener. The results, although very few, nevertheless are interesting, since they tend to indicate the intermediate cold layer and the correct bottom temperatures, which the experiments made by Sir James Ross and the *Challenger* failed to show. They are also similar to readings at similar depths of the Arctic seas.

On December 26, at 1.30 a.m., there was a dead calm; the dry-bulb fell to 24·6° Fahr., and a very thin layer of ice formed on the surface of the water. The temperature of the water was 31·1°, and

the specific gravity 1·0269 for that temperature by the salinometer. Again on January 7 there was a dead calm, and the surface of the water froze, the dry-bulb standing at 31·3°. This time I had no means of taking the temperature and salinity of the water. On January 17 I lowered the thermometer and kept it in four or five minutes in a long cylindrical hole about 6 inches in diameter in a piece of honeycombed pack-ice about 1 foot below the surface; the piece of ice was slowly passing across the stern of the vessel. I found the temperature to be 31·2° Fahr. The thermometer had the usual small cistern, which contains a considerable amount of water surrounding the bulb, and in this, as in other cases, as little time as possible was lost in drawing up and reading the instrument. On February 17, when the dry-bulb registered a temperature of 20·8° Fahr., the lowest record on the *Balæna*, there was no sign of ice forming on the water, but the water was far from smooth; a considerable amount of ice, however, was formed on the bows and other parts of the vessel exposed to spray.

South of Joinville Land we never experienced much swell, even during and after the hardest gale; it was interesting to note how a comparatively narrow stream of ice always broke the swell.

Not much attention was paid to currents. In the neighbourhood of Danger islets they were very strong; at times it was difficult for the vessel to make headway against them. These, I should say, were most likely tidal. In the neighbourhood of bergs they were also impetuous. I was in one of two boats one day that pulled for about four hours in the neighbourhood of a berg, and so strong was the current that we were only just able to hold our own against it. Near bergs the drift-ice moves very fast, now onward, now swaying round, caught in a whirlpool, and boat-steerers have to keep a sharp look-out to prevent being nipped.

Here follow the few observations made on currents:—

December 24.—64° 13′ S. and 56° 14′ W. Current S.E. by S.

January 1.—S.E. of Danger islands. Current W., 2 or 3 knots per hour.

January 29.—S.E. of Danger islands. Current strong.

February 2.—3 miles E. of Danger islands. Current S.W., slight.

On several occasions I threw out floats.*

Weather.—The meteorological observations of the expedition are more complete than any other set of observations, and for general (though perhaps more for local) conditions we have some interesting notes.

Periods of calms and gale alternate in this part of the world. On Christmas Eve and Christmas Day there was a perfect calm; the sky, except at the horizon, had a dense canopy of cumulus rolls, which rested on the summits of the western hills, and when the sun was just below the horizon, the soft greys and blues of the clouds and the

* Up to the end of 1895 none of these floats had been recovered.

spotless whiteness of the ice, as it floated in the black and glassy sea, were tinted with the most delicate of colours—rich purples and rosy hues, blues, and greens passing into translucent yellows. This was a very typical calm day, but there were also calm days with cloudless skies and brilliant sunshine. Should a gale blow from a southerly direction, it was usually accompanied by snow, and if from a northerly direction, by wet fog, as shown below :—

FEBRUARY 8, 1893.

Time.	Wind Force 1–12.	Clouds, 0–10.	Weather.	Dry-bulb.
1	N.W. 3	—	thick wet fog	32·3
8	N.N.E. 4 to 5 ...	10	overcast; thick very wet fog, and raw	32·8
10	N.N.E.	10	overcast; foggy, raw, raining	31·9
12	N. by W. 2	10	overcast; thick fog; very wet sky	33·4
16	S.W. 6 to 7	10	overcast; misty round horizon	30·1
20	S.S.W. 10	10	overcast; snow showers since 6 p.m.	29·6
22	S.S.W. 10	10	overcast; snowing; coarse dirty night	29·2

On January 29, 30, 31 and February 1 we had a hard gale. It blew chiefly from the S., but backed and veered between S.S.W. and S. by E. At times on the 29th and 30th I have recorded wind of a force up to 10. On the 29th I have noted that this was pronounced by all to be the heaviest of all since we made the ice; on the 30th the skipper told us that had we been in the open ocean, with our vessel in good trim, she would scarcely have borne close-reefed topsails. From 10 p.m. on the 29th till 8 a.m. on the 30th we steamed full speed* against the wind, and only made about 1 mile headway. Snow was falling almost continuously, being very fine and slight. The thermometer fell from 31·7° Fahr. to 27·7° Fahr. Again on February 10 I have recorded a brief N.W. and N.N.W. gale, after which there were some hours of calm. The wind by 8 a.m. on February 12 had veered to S., force 1, and, remaining S., increased to force 8 by 11 a.m., rising to a recorded 11 to 12 at noon. At 4.30 a.m. on the 13th it had not abated in the least; from 8 a.m. to 3 p.m. force 8 is recorded, and in the evening there was only a strong breeze. In this instance I must have recorded too great a force according to some authorities, since I am here to tell the tale; but our captain described it as the hardest gale that ever blew in the Arctic or the Antarctic, and so hard that we could not have borne close-reefed topsails in the open. For part of the time thick fog prevailed, and fine snow was driven before the wind. The thermometer fell from 32·4° Fahr. to 25·2° Fahr. The barometer was lowest at 10 a.m. on the 12th, standing at 28·978 inches, and by 1 a.m. on the 13th had only risen to 29·057.

* Under most favourable conditions, calm sea and no wind, the vessel can steam 8 knots.

Observations were made every two hours as far as was possible, and have been grouped in twelve columns for each day. The mean of these has been calculated for every month, and again from these twelve means the mean temperature of the month has been obtained. In no case does the mean monthly temperature exceed that of the freezing-point of water. For the last two weeks of December it was 31·1° Fahr., which was also the mean temperature of January, while that of the first eighteen days of February was 29·7° Fahr. In the region traversed from lat. 61° S. to 64° 40′ S., and from long. 53° W. to 57° W., which may roughly be compared to that of the Færoës in the northern hemisphere, the mean air-temperature in the month of maximum temperature is half a degree below the freezing-point, instead of about 23 degrees above it. It may be assumed that January is the warmest month, since the observations made in December, while giving the same mean temperature, were obtained only in the latter, and presumably the warmer, fortnight of the month. Except for the rise at 6 a.m. in December, which is the mean of only two readings, and is therefore not considered, the two hourly mean temperatures cross the line of the melting of ice only at 4 and 8 p.m. in December, and at 2 p.m. in January, the mean maximum at 2 p.m. in February coming within two-tenths of it.

The warmest twelve hours of the day (8 a.m. to 6 p.m.) averaged 31·5° in December, 31·4° in January, and 30·5° in February; while the night temperatures (8 p.m. to 6 a.m.) were 1·1° lower in January, and 2·9° lower in February (the night means cannot be calculated satisfactorily for December).

The following table shows the maximum and minimum readings in each month and for the whole period:—

	Maximum.	Minimum.	Range.
1892.			
December 16–31 ...	37·1°, noon on 16th	24·6°, 1·30 a.m. on 6th	12·5°
1893.			
January 1–31 ...	37·3°, 2 p.m. on 15th	27·7°, 8 p.m. and midnight on 30th	9·6°
February 1–18 ...	36·2°, 4 p.m. on 7th	20·8°, noon on 17th	15·4°

Hence the extreme temperatures recorded were—maximum 37·3° and minimum 20·8°, giving a range of 16·5° Fahr.

As with temperature observations, pressure observations were made every two hours, as far as was possible, and have been grouped in twelve columns for each day. The mean of these has been calculated for every month, and the whole period mean has been obtained. The mean pressure for the last two weeks of December was 29·357 inches; for January, 29·273 inches; and for first eighteen days of February, 29·160 inches. There is thus a falling off in pressure from December

to February, the mean for the whole period, December 16 to February 18, being 29·263 inches, or about half an inch lower than for the corresponding season in the Fœröe islands. All the means attain a maximum at 10 a.m. and 6 p.m., and all, except those for February, at midnight also. There seems to be a minimum period during the early morning hours. On the whole the pressure appears to be greater in the afternoon than in the forenoon; but the forenoon data are insufficient for obtaining reliable results.

The following table shows the maximum and minimum readings in each month and for the whole period :—

	Maximum.	Minimum.	Range.
1892.			
December 16-31 ...	29·834, 6 a.m. on 16th	28·801, 8 a.m. on 20th	1·033 in.
1893.			
January 1–31	29·753, 4 p.m. on 2nd	28·745, 10 p.m. on 20th	1·008 in.
February 1–18	29·750, 4 p.m. on 6th	28·850	0·896 in.

Hence the extreme pressures recorded were—maximum 29·834 inches, and minimum 28·745 inches, giving a range of 1·089 inch.

Biology.—Prof. D'Arcy Thompson has treated biology at sufficient length for so general an account as this, and with much greater skill than I should. It may be mentioned, however, that we saw no whale in the least resembling the Greenland or bowhead whale (*Balæna mysticetus*), but many finners, hunchbacks, bottlenoses, and grampuses. Also four species of seals, all of them true seals, viz. the sea-leopard (*Stenorhynchus leptonyx*); Weddell's false sea-leopard (*S. Weddellii*); the crab-eater, or white Antarctic seal (*S. carcinophaga*); Ross's large-eyed seal (*S. Rossii*).*

Between the Falkland islands and the ice, and in the ice, I saw several white ropy-looking coils in the water, about a foot or so in length, and about an inch thick. I succeeded in securing one, but this, unfortunately, was heaved overboard before I could preserve it. This, a compound ascidian, was seen by Sir Joseph Hooker, in 1843, and later by the *Challenger* in 1873, but is now for the first time fully described.

All these observations were made, and these specimens procured, between December 16, 1892, and February 13, 1893. On the latter date we had glutted our ship with seals, and turned her head homewards. The following afternoon we passed Clarence island, the most easterly of the Shetland group, its three bold ridges looming through mist and scud. The land was wild and majestic, towering over the

* "Notes on Seals and Whales seen during a Voyage to the Antarctic" (Brit. Ass., Nottingham, 1893), by W. S. Bruce. Also "Animal Life seen on a Voyage to the Antarctic," *Proc. Royal Phys. Soc.*, vol. xii. pt. 2, xxvi. pp. 350-354.

adjacent icebergs. Like other land we had seen, it was entirely snow-clad, except on the most precipitous slopes, which were short and abrupt to the south, but long and easy to the north. On February 20, at 9 a.m., we passed our last berg in about 60° 27′ S. and 53° 40′ W., or about 40 miles north of Clarence island. Port Stanley was reached on the morning of February 28; Portland on May 24; and finally, on May 30, we came to rest at Dundee.

(*To be continued.*)

APPENDIX I.

Preliminary report on rock specimens obtained by W. S. Bruce from floating ice and from the stomach of penguins, by Professor James Geikie, LL.D., F.R.S.:—

"The large specimens of the dark rock are all basalt, and contain a good deal of olivine. There is nothing peculiar about them, for they exactly resemble many of the basalts obtained in this and other European lands.

"The small fragments obtained from the stomachs of penguins show little variety. So far as I can judge, without microscopic examination, they consist mostly of basalt. A few, however, seem to be trachyte. Most of the specimens appear to be water-worn more or less, and exactly resemble the small subangular and partially rounded *débris* which, along with larger fragments, one finds upon the coasts of a region composed of igneous rocks. I could find no trace of sedimentary or schistose rocks amongst the samples."

APPENDIX II.

Preliminary report on samples of marine deposits obtained by W. S. Bruce off the eastern extremity of Joinville island, by John Murray, LL.D., PH.D., etc., and Robert Irvine, F.C.S., etc.:—

"The samples of marine deposits from the eastern side of Joinville island come from depths of 130 to 235 fathoms. Those from the lesser depths consist of fragments of polyzoa and basaltic gravel. Some samples consist of basaltic and quartz sand. The samples from the greater depths consist of blue muds made up of many particles of quartz, volcanic rocks, feldspars, hornblende, augite, tourmaline, together with a few globigerina and other foraminifera, many diatoms and sponge spicules, and amorphous clayey matter. The mineral particles indicate that the adjoining land contains true continental rocks."

APPENDIX III.

Preliminary report on samples of sea-water obtained by W. S. Bruce between latitudes 56° S. and 63° S., and between longitudes 54° W. and 56° W., by John Murray, LL.D, PH.D., etc., and Robert Irvine, F.C.S., etc.:—

ANALYSIS OF ANTARCTIC WATERS.

Position.		$_0S_0$.	$_{17.5}S_{17.5}$.	$_4S_{15.56}$ Calculated from $_0S_0$.	χ. (Chlorine.)	CO_2 Milligrams per *Kilo.*	D $\frac{_0S_0-1000.}{\chi}$	D_1 $\frac{_0S_0-1000.}{CO_2}$
62° 31′ S. 54° *x*′ W.	surface	1027·37	1025·93	1025·10	18·777	49·95 *	1·4576	0·5480
56° 25′ S. 55° 35′ W.	surface	1027·32	1025·88	1025·06	18·746	48·94 †	1·4575	0·5582

APPENDIX IV.

Preliminary report on biological collections brought home by the naturalists of the Antarctic Expedition, by Professor D'Arcy Thompson :—

"The collections brought home by Mr. Bruce, of the s.s. *Balæna*, and the other members of the recent expedition to the Antarctic were not large, but almost everything that they contained was interesting. Owing to the circumstances that my laboratory and museum (in which most of the specimens have been deposited) are at present being rebuilt, I can only give, in the mean time, the merest outline of the principal contents. The collection of birds was a very good one, but it is a matter of great regret that the bulk of it was retained by the captain of the *Balæna*, and has been dispersed owing to Captain Fairweather's too modest estimate of its interest and value. Among the specimens thus dispersed was a small gull with coral bill and dove-coloured neck and throat, which I only saw for a few moments, and which appeared quite new to me.

"Three splendid skins of emperor penguins were secured, all very large ; in one case the bird had weighed 74 lbs. A whole skeleton and a portion of a second were prepared by Mr. Bruce and presented to our museum. Skins, and in most cases skulls, were also obtained of the black-throated penguin, *P. padeliæ* ; of the so-called *P. Herculis*, doubtless the same species in immature plumage ; and of *P. tæniatus*, the ringed penguin. The white-headed penguin, *P. papua*, was also observed in quantity, and a skull and egg are in the collection. This very valuable series of penguins has been fully described by Dr. Donald of the s.s. *Active*, in a paper about to be published by the Royal Society of Edinburgh.

"The other birds do not call for much remark, except perhaps one specimen of the Antarctic skua, in which the golden tinge on the brown feathers of the breast is very conspicuous.

"A small dolphin, not yet identified, but probably a young specimen of a known species, was brought home from the Falklands. Among the invertebrates, by far the most interesting specimen is one of the great compound Ascidian, apparently identical with that mentioned by Professor Herdman in the 'Challenger Report.' This form has not hitherto been named on account of the bad condition of the *Challenger* specimen, and another in the British Museum ; but the present specimen is fairly well preserved, and promises to be of great interest. A considerable number of shizopod crustaceæ of the genus *Euphamia* were preserved. They are all large species. One of them appears to be identical with *E. Murrayi* (Sars), of which only two specimens are recorded in the 'Challenger Report.' The others we have not yet identified, and some at least are almost certainly new.

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* = 51·2 per litre. † = 50·17 per litre.

"The tow-nettings from the Antarctic consist almost entirely of the characteristic diatomaceous genus *Corethron*, which is present in a very large number of forms.

"On the homeward voyage, Mr. Bruce took a number of tow-nettings in the south temperate and torrid zones of the Atlantic. In these the copepods are well preserved and very numerous; but we have not examined them, nor shall we do so until the report is published of the *Buccaneer* collections, with which these will doubtless closely agree.

"On the whole the zoological collections of the expedition are disappointingly small. But it must be remembered that in the hurry and work of a sealing and whaling voyage no attention can be spared to the naturalist's need, unless, indeed, special arrangements have been made, and the cost of the voyage in part defrayed with that end in view. But, on the other hand, of the collections brought home, the objects gathered in the extreme south are one and all either new or rare, and whet our appetite for further scientific exploration of the Antarctic seas."

TABLE OF SOUNDINGS.

(W. S. Bruce.)

Date.	Civil hour.	Depth in fathoms.
1892, December 17 ...	Noon	100, no bottom.
No. 3, „ 20 ...	19.30	161
„ 21 ...	9.0	142
No. 6, „ 21 ...	10.0	140
„ 21 ...	11.30	139, white sand.
„ 21 ...	12.0	139, white sand.
No. 7, „ 21 ...	20.0	170
No. 8, „ 21 ...	22.0	147
No. 9, „ 22 ...	2.0	180
No. 13, „ 22 ...	6.0	130
No. 17, „ 22 ...	10.0	235
No. 18, „ 22 ...	14.0	235
No. 19A, „ 22 ...	20.0	175
„ 23 ...	9.30	80, rock.
„ 23 ...	14.0	126
„ 23 ...	24.0	180
„ 24 ...	20.0	194
„ 25 ...	20.0	200
„ 28 ...	18.30	121
1893, January 20 ...	10.0	305, no bottom.
„ 22 ...	20.0	310, no bottom.
„ 23 ...	18.0	310, no bottom.
February 1 ...	14.0	130, sand and small stones.
„ 1 ...	18.0	130, sand and small stones.
„ 1 ...	22.0	138
„ 1 ...	24.0	132
„ 2 ...	between 2.0 and 8.0	140
„ ...	19.20	160, rock.
„ 5 ...	10.0	200
„ 5 ...	14.0	140, green mud.
„ 5 ...	19.30	109, stones and mud.

The numbers are those of samples from the lead which have been preserved.

TABLE OF SURFACE AND DEEP SEA TEMPERATURES.

(W. S. Bruce.)

Depth in fathoms.	Dec. 20, at 19.30	December 21, at					December 22, at			D.c. 24, at 20	Dec. 25, at 20	Dec. 28, at 18.30.	Jan 20, at 10.	Jan. 23, at 18.	Feb. 1, at 18.	Feb. 2, at 19.20.	February 5, at		
		9	10	12	21	22	10	14	20								19	14	19.30
Surface ...	29·9 at 20 hrs.	30·1	—	—	30·7	31·0	31·4	30·9	29·7	31·3	31·6	—	30·8	30·7	29·9	—	29·9	30·1	30·1
50	—	—	—	—	—	—	—	—	29·7	29·3	—	—	—	28·8	—	—	30·4	—	30·6
60	—	—	—	—	—	—	—	—	—	—	29·2	—	—	—	—	—	—	—	—
100	—	—	—	—	—	—	—	—	—	29·2	—	—	—	29·6	—	—	—	29·8	—
108	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	30·0
120	—	—	—	—	—	—	—	—	—	—	28·8	28·8	—	—	—	—	—	—	—
129	—	—	—	—	—	—	—	—	—	—	—	—	—	—	30.8	—	—	—	—
138	—	—	—	29·4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
139	—	—	29·5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	29·8	—
141	—	29·5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
146	—	—	—	—	—	28·8	—	—	—	—	—	—	—	—	—	—	—	—	—
159	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	30·2	—	—	—
160	29·8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
169	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
174	—	—	—	—	—	—	—	—	29·5	—	—	—	—	—	—	—	—	—	—
193	—	—	—	—	—	—	—	—	—	28·6	—	—	—	—	—	—	—	—	—
199	—	—	—	—	—	—	—	—	—	—	28·9	—	—	—	—	—	29.3	—	—
234	—	—	—	—	—	—	28·7	28·6	—	—	—	—	—	—	—	—	—	—	—
304	—	—	—	—	—	—	—	—	—	—	—	—	32·1	—	—	—	—	—	—
309	—	—	—	—	—	—	—	—	—	—	—	—	—	32·0	—	—	—	—	—
Bottom in fathoms	161	142	140	139	170	147	235	235	175	194	200	121	no bottom at 305	no bottom at 310	130	160	200	140	109
Positions	62° 18′ 53° 45′	—	—	62° 21′ S. 54° 3′ W. noon.	—	—	—	63° 2′ 54° 31′ noon	—	64° 13′ 56° 14′ noon.	64° 25′ 56° 14′ noon.	64° 2′ 56° 23′ noon	64° 40′ 55° 0′ 10 hrs.	66° 55′ 54° 33′ 18 hrs.	53° 16′ 63° 28′ noon	52° 58′ 63° 22′ 19.20 hrs.	— —	62° 33′ 54° 18′ noon	— —

Until December 25 positions are correct; after that date there exists some doubt, but the positions may be regarded as very nearly correct; they are the best results obtainable. The deep-sea thermometer has not been corrected for error. It was supplied by A. Frazer, Edinburgh. The surface thermometer was B.T., No. 3211, and has been corrected.

Date.	Wind.		Barometer.		Thermo.		Weather.	Sea surface.	
	Direction.	Force.	Barometer.	Att. ther.	Dry.	Wet.		Temp.	Sp. gr.
1892.									
December 17	W.	3·3	29·445	58·67	35·55	35·22	F.	34·78	29·0
18	N.E. / W.	2·5 / 4·3	29·261	54·27	33·52	33 23	Fr.	32·50	29·5
19	N.W. / N.N.E.	1·9 / 4·6	29·278	48·97	34·00	33·72	O.F.	32·17	27·5
20	N.N.E.	2·6	28·962	49·28	33·95	33·63	F.	31·53	26·5
21	N.W.N.	1·7	29·104	45·83	32·97	32·33	F.	31·55	27·5
22	E.	1·5	29·091	48·67	32·28	31·67	F.	30·95	28·0
23	S.	2·2	29·264	51·47	33·42	32·45	O.G.	32·25	27·5
24	S.	2·0	29·470	49·48	32·84	31·80	C.B.S.	32·74	27·0
25	S.	0·3	29·689	49·30	32·53	31·45	C.B.	32·52	28·0
26	E.	2·3	29·763	51·05	30·15	29·48	O.	32·18	27·0
27	E.	5·0	29·595	47·75	31·15	31·20	O.G.	31·52	27·5
28	E.	4·6	29·509	41·13	31·27	31·27	O.G.M.	31·90	27·0
29	N.N.E.	3·6	29·499	48·15	31·32	31·32	O.G.	31·76	27·0
30	E.	2·0	29·548	49·35	30·14	30·25	O.	31·07	27·0
31	S.E.	1·6	29·384	47·08	31·65	31·10	C.B.	31·28	27·0
1893.									
January 1	E. & N.	1·9	29·624	45·08	31·70	30·62	C.	31·58	27·5
2	N.	1·4	29·633	48·60	31·55	34·55	B.	32·33	27·5
3	N.E.	4·1	29·497	47·70	33·67	32·52	O.S., C.B.	31·87	27·5
4	N.E.	3·0	29·409	46·72	33·80	33·03	O.M.Q., 5 S.	31·92	27·0
5	Calm	0·0	29·512	48·70	34·76	34·00	O.	32·20	27·0
6	E. & N.E.	3·2	29·416	49·95	35·38	34·15	O.S.Q.	32·10	27·0
7	W.	0·8	29·481	50·40	35·00	33·64	O.S.	31·92	27·5
8	W.	1·7	29·424	51·67	34·73	33·88	O.M.F.	32·32	27·5
9	N.E. / N.W.	1·5 / 0·2	29·270	50·90	35·23	34·52	O.F.	33·08	27·0
10	S.	5·2	29·150	43·50	32·20	31·62	O.M., 10 S.	31·87	27·5
11	Calm	1·0	29·390	50·08	36·10	34·82	C.B.V.	32·34	27·5
12	N. / S.E.	3·4 / 1·7	29·241	48·82	33·28	32·55	O.S.	32·03	28·0
13	E. / Calm	1·4 / 0·0	28·379	49·54	33·02	32·12	O.F.	32·02	27·5
14	N.E.	1·2	29·604	47·27	35·05	33·28	C.B.	32·30	27·5
15	N.	2·1	29·685	48·77	34·57	33·40	B., F.	32·03	27·5
16	N.N.E.	2·9	29·655	44·27	31·72	31·15	F.	31·80	27·5
17	N.	3·8	29·682	46·03	33·50	32·75	O.M.G.	32·23	27·5
18	N.W.N.	3·6	29·452	46·63	34·15	33·78	F., O.M.G.	32·05	27·0
19	W.	4·2	29·051	44·83	33·03	32·17	O.G.M., F., IV., 6 S.	32·05	26·5
20	W.	2·9	28·934	46·20	34·22	33·80	O.F.G.	32·38	26·5
21	W. / S.	1·3 / 2·0	28·897	47·52	34·12	33·38	F., C.B.	32·88	27·0
22	W.	1·0	29·119	48·38	34·70	33·44	O.M., C.B.	32·74	27·0
23	Calm / E.	0·0 / 3·0	29·122	49·28	32·15	31·27	C.V., O. 3½ S.	31·42	27·0
24	E. & S.	3·8	28·741	48·88	31·87	31·35	O.M.S.	31·72	27·5
25	S.	3·3	29·105	48·30	32·02	31·63	O.M.D.	32·13	27·5
26	S.S.E.	1·5	29·415	48·92	32·77	31·85	O., C.B.	32·40	27·5
27	E.	0·7	29·563	45·00	32·78	30·93	C.B.	32·05	27·5
28	S. & E.	2·8	29·474	43·55	30·92	29·78	C.B.	31·62	28·0
29	S.	6·7	29·161	41·67	29·98	29·74	C.B.	31·23	28·0
30	S.	7·2	28·624	40·26	29·38	29·00	O., C.	30·80	27·5
31	S.	6·6	29·089	48·52	30·32	30·32	O.M., 11 S.	31·58	27·5
February 1	S.	6·3	29·014	43·77	30·65	31·57	O.M., 10 S.	32·05	27·5
2	S.E.	2·3	29·165	47·80	31·28	31·08	O.	31·88	27·5
3	S.E.	2·5	29·128	49·14	31·46	30·78	O.V., O. 3 S.	31·50	27·5
4	S.E.	4·5	29·010	31·47	31·62	31·43	O.F., 16 S.	31·12	27·6
5	S.S.E.	5·2	29·299	45·40	31·28	31·05	O.M., 12 S.	31·27	27·2
6	S. / W.	2·6 / 2·2	29·723	44·13	33·22	31·85	C.B.V.	31·50	27·0
7	W.N.W.	2·8	29·399	46·23	35·05	34·23	O.F., 4 S., C.B.V.	31·73	27·3
8	N. / S.W.	2·1 / 7·0	29·099	46·80	30·48	31·88	O.F., 3 E.D., 4 S.	30·95	27·8
9	S.S.W.	4·4	29·520	44·50	31·18	30·55	O.M.	31·58	27·2
10	N.N.W.	3·4	29·433	45·57	33·73	33·49	O.M.	31·43	26·5
11	N.W.	2·7	29·254	47·72	34·62	33·93	B.C.F.	31·13	27·0
12	S.S.E.	5·4	29·141	43·35	29·24	24·90	O.F., 11 S.	30·76	27·0
13	S.	7·0	29·246	42·73	26·13	25·75	O.Q.S.	31·22	27·4
14	S.S.E. / N.W.	1·8 / 3·3	29·131	45·30	28·75	28·25	C.B., O.M.	31·82	27·0
15	E.	2·7	29·097	43·83	29·43	28·58	O.M., 10 S.	31·13	27·2
16	N.E. / S.E.	3·4 / 6·0	29·008	52·26	30·60	31·04	O.M., 5 S., IV., 4 D.	30·94	27·5
17	S.S.E.	4·6	29·152	42·92	24·12	24·17	C.	30·00	27·5
18	N.E. / N.N.W.	1·4 / 3·4	29·330	46·73	31·94	31·58	O.M.G.F.	30·68	27·4
19	N.N.W.	3·9	29·181	49·63	35·33	35·05	O.F., 11 D.	31·77	27·5
20	W.N.W.	2·7	29·101	48·27	33·28	32·77	F., 4 D., C.B.	31·32	27·0
21	W.N.W.	4·3	29·254	51·14	35·18	34·66	C.B.	31·34	27·2
22	N.W.	4·9	29·310	53·42	35·56	34·86	O.M.F.	31·26	27·8
23	N.N.E.	2·0	29·030	48·77	32·72	32·63	O.M.F.D., 8 V.	30·98	27·0
24	S.W.	5·3	29·248	44·50	30·30	30·05	O.M.F., IV., 4 S.	30·83	26·0
25	W.S.W.	2·6	29·184	53·13	33·73	33·57	O.M., C.B.	33·40	26·8
26	S.W.W. / W.N.W.	4·9 / 4·0	29·542	55·68	38·55	37·92	C.B., O.M., 1 V.	36·82	26·5

thermometer was B.T., No. 3211, and has been corrected.

JOURNAL OF AN EXCURSION IN OMAN, IN SOUTH-EAST ARABIA.*

By Colonel S. B. MILES.

It is, perhaps, needless to remark that our present geographical knowledge of Oman, in Eastern Arabia, and especially of its orographical system, is derived almost exclusively from the map of Lieut. Wellsted, I.N., whose 'Travels in Arabia' was published in 1838. The value of the work accomplished by Wellsted has been universally acknowledged, and, considering the difficulties he had to contend with as the pioneer explorer, he deserves the greatest credit and commendation for the light he has thrown on the country.

Among the regions Wellsted did not personally visit, and consequently did not describe, is that portion of the great mountain chain which forms the backbone of Oman, lying between Maskat and Ras Al Had.

The system of mountains hereabouts is somewhat complicated, but may be said to consist broadly of two parallel ranges forming a continuation of the Jebel Akhdar chain, and embracing between them as far as Kuryat a rich and thickly peopled valley known as the Wadi Tyin.

This valley, which rises a little to the north-east of Semmed, terminates at Ghubra el Tam, where the torrent has excavated its way through the hills, forming a very remarkable cañon or channel, the seaward side of which is known to navigators as the Devil's Gap.

The exterior of this gap I had seen in 1874, in company with an officer of H.M.S. *Rifleman*—Lieut. Black, who afterwards unfortunately perished in the ill-fated *Eurydice;* but the opportunity of fully exploring the gorge and the Tyin valley did not occur until ten years later. In the month of February, 1884, however, I was able to make arrangements for the journey, and the Sultan H. H. Seyyid Turki appointed Seyyid Nasir bin Mohammed Al Bu Saidi to lead the escort, our guide and kefir being Shaikh Nasir bin Gharayib el Jabri, who was directed to join our party the next day at Natat.

It was on the morning of the 11th that we mounted our camels and rode out of Mattrah into the broad and shallow Wadi Harmal, or "Vale of Rue." Passing Felej castle and the village of Ruwi, one of the market gardens of Maskat, we strike off to the left up the Wadi Adi, a winding gorge or defile about 4 miles in length cut through the hills, which leads into and drains part of the small plain called Seh Hatat, a basin or opening in the lofty and precipitous hills behind Maskat. The Wadi Adi, which has a rough stony bed of many colours, and the mural surfaces of which disclose a singular variety of geological strata, bifurcates at its outlet from the hills into two streams, the

* Map, p. 576.

torrent after heavy rain pouring not only into the Wadi Harmal, but also into the watercourse that runs by El Wateyeh.

At 10 miles from Mattrah, we arrive at Al Birain, a hamlet of the Beni Wahaib tribe, so called from two copious fountains issuing from the rocks hard by. From these springs two new felejes, or underground streams, have been conducted for the purposes of irrigation. The water being sweet and unfailing, orchards and gardens have been planted, and are thriving famously. Palms and various fruit trees, grain, and lucerne luxuriate here. A lofty tower, that indispensable and ubiquitous adjunct to an Arab settlement, without which the source of water-supply for the use of the inhabitants would lie at the mercy of their enemies, is being built on a gentle eminence, and will soon be completed. I had heard something about these felejes at Maskat, and was therefore much interested at seeing them. One of them was the property of a joint-stock company there, of which the Sultan's wazeer was the chief shareholder and promoter. The other shares were held by Indian merchants. The spring had been purchased from the Arab owners for a consideration, and I found that the shafts of the felej had been already sunk, and that the underground connections were in progress. The shareholders receive the water in their gardens in proportion, of course, to their interest in the company, the allotment being made every ten days. We halted here for the night. The elevation above the sea is 420 feet.

In the mountainous parts of Oman the roads run almost invariably along the beds of the hill torrents or wadies, which form the natural highways into the interior, and are sometimes sandy watercourses, sometimes deep rocky ravines, and sometimes broad fertile valleys.

Our second march was to lead us over the northern and more elevated of the two mountain ranges I have mentioned above, by the Kahza pass, which forms one of the main channels of communication between Maskat and the Sharkiyah, or eastern district of Oman; and as our day's journey was likely to be a long and toilsome one, we started early in the morning, and travelled in a southerly direction to where the Wadi Kahza enters the plain. This expanse is occupied not only with the usual stunted trees and shrubs of the wilderness, which are in this land never too abundant, and which have been here sadly diminished by the race of woodcutters who infest the neighbouring valleys to supply Maskat with firewood, but also with many singular natural pillars of considerable size, their surfaces indicating, with a precision that would be very interesting to a geologist, the composition of the surrounding hills.

We soon enter the Wadi Kahza, and commence the ascent up a gentle gradient along a good gravelly bed, treeless and waterless, cut through a deep bed of coarse conglomerate.

By-and-by we pass on our left the outlet of the Wadi Amda, which,

scoring the northern side of this range in a direction almost parallel with the Wadi Kahza, forms a shorter and more direct route to the Tyin valley. It is, however, a very rugged and difficult pass, the defile, I was told, being only a foot wide at one part, with a wall of rock on one hand and a precipice on the other. After a short rest under the grateful shade of a clump of large trees, we pursued our journey up the ravine for an hour and a half, the acclivity gradually increasing in sharpness as we proceed. Above us here tower two lofty peaks, one on either side, that to our right being a cap-shaped point called Jebel Sell. And now commenced the real struggle of the ascent, the zigzag path of which was so frightfully steep, and the footing so rugged and insecure, that the camels, though helped and encouraged with the utmost endeavours of the Arab drivers, only climbed it with extreme difficulty.

By the time we had reached the summit at 3 p.m. I was able to realize the truth of the warnings given me beforehand by the Arabs as to the perilous nature of this pass for beasts of burden, for the wayside was strewn with the whitening bones and skeletons of camels that had fallen over the edge and been left to perish. Fortunately, we had no fatal accident, though five of the animals fell during the ascent, and bruised their legs. The elevation of the Akabat el Kahza I found to be 3900 feet; but Jebel Tyin, which stands in front of us, is a giant by comparison, and rears its head to an altitude of 5250 feet. Just as we mounted the top we met Shaikh Saud bin Hamad of the Rehbiyin tribe, who was on his way to Maskat to solicit pardon from the Sultan for his perfidious conduct in opening the road to the rebel army on their way to besiege that town in September, 1883, on which occasion they were completely defeated. The Rehbiyin tribe have for many centuries possessed and occupied the Kahza pass, and have always been in receipt of an annual subsidy for holding it closed against the Sultan's enemies. The rencontre with our party did not appear very pleasing to the shaikh, who had always been profuse in his protestations of loyalty to the government, and after a hasty salutation he commenced to descend the path by which we had ascended.

With our faces still towards the south, we crossed the ridge and began to move down the Wadi Mugheira, a ravine which I found, to my surprise, to present not only a more severe gradient, but even a more rugged and formidable path than the Kahza. The banks are as steep as if artificially scarped, for the stratification is vertical or at very obtuse angles, and runs parallel to the direction of the wadi. Shapeless blocks of blue limestone, large enough to form a serious obstacle, are piled up in profusion in the rocky bed, rendering our progress very slow. Patient and docile as the camels were, it seemed impossible sometimes that they could extricate themselves from the confused masses of rock among which they appeared to be entangled, and keep

their feet on the slippery water-worn stones; but their drivers managed to get them through without mishap.

Owing, perhaps, to the protection afforded by the rugged nature of this torrent bed, and also to the presence of pools of water among the huge rock fragments, vegetation is tolerably abundant—tamarisks, oleanders, kafas, euphorbias, the tirucalla or milkbush, rhamnus, and acacias are the most common and characteristic, but many others I did not know are to be seen.

It was nearly sunset before we were able to remount our camels, and quite dark before we reached the foot of the Mugheira ravine, where we were to camp. Here we found water, but no shelter, and as it was too late to look about, we lighted fires and bivouacked for the night. Our camping-ground was 2070 feet below the summit of the Kahza pass, and the air was cold and humid here, owing to the quantity of vegetation and the numerous pools of water around.

On the following day we retraced our steps for a short distance, and then, turning to the south-east, began to ascend the Wadi Mansab, a broad highway with a slight acclivity and smooth, sandy bed, offering an excellent road. This wadi flows into the Wadi Semail near Surur, and forms, indeed, the principal route between the Tyin and Semail valleys. There are two large villages, Subh and Nafaah, in it, besides several hamlets, and it is fringed along the greater part of its course with fine date groves. I had been advised at Maskat before starting to travel by the Semail-Mansab route as the more easy and convenient way, but I had decided on taking the shorter though more troublesome route, as I was anxious to examine the Kahza pass, which I had never seen, while the Semail valley was very familiar to me. The nejd or upland of the Wadi Mansab was reached in two hours, and we soon espied in front of us the village of Al Wasit, belonging to the Rehbiyin, where I intended to halt.

The quarters assigned to me were in a pretty orchard composed of numerous fruit trees interspersed with flowering shrubs and plants, and here I soon made the acquaintance of the whole community, a very small one certainly, who crowded round to see their first English visitor. Our march this day had been a very short one, only 6 miles, as the camels wanted rest after the fatigues of the Kahza pass. Al Wasit is a picturesque little place in itself, but its surroundings are bleak and desolate in the extreme. Situated on the barren slope of the mountain range, nothing meets the eye but dark masses of hills, exhibiting no signs of human habitation, and decked with but scanty verdure. The head shaikh of the tribe resides here with his attendants, but there is no village, as the paucity of water does not admit of a large population. One little rill trickling from a neighbouring glen is allowed to collect in a reservoir, from which it is drawn economically for domestic use and irrigation. Notwithstanding its apparent insignificance, however, Al

Wasit is much frequented by native wayfarers and traders, as well as by the chiefs of other tribes, who come to visit the influential Shaikh of the Rehbiyin, Salim bin Hassam bin Mohammed, who at this time happened to be away.

On occasions when the martial tribes of Al Sharkiya contemplate rising and marching on Maskat with the object of extorting concessions from the Sultan, or of ousting him in favour of some rival, it becomes a matter of importance to gain over the tribes holding command of the various mountain passes through which a passage for the invading army must be purchased or forced. Most of the tribes holding such passes as Akk and Kahza are in receipt of a regular stipend from the Maskat government to keep them closed against the tribal coalitions on the war-path, but this precaution does not always avail. In September, 1883, the Rehbiyin tribe had played false to the Sultan, and, though in receipt of a good subsidy, had listened to the cajolements of Seyyid Abdul Aziz and Shaikh Salih bin Ali, and had given passage to the enemy, whereby they had been able to pour down the Kahza pass with such secrecy and dexterity as to take his Highness by surprise. The attack, however, owing in great measure to the support afforded to the Sultan by H.M.S. *Philomel*, which shelled the rebels from their position, an action fully approved by our Government, had signally failed. Some of the rebels had been already chastised, and the Rehbiyin, among others, were still afraid of reprisals against themselves.

February 14.—The road hence to the Wadi Tyin led us in a south-easterly direction down the Wadi Wasit, a well-wooded shallow water-course with a few palms. Leaving this nullah through a small gap between two vertical cliffs of white limestone, we arrive, after a short ride, at Naksa, a hamlet lying at the angle formed by the junction of the two wadis, and, passing this, we find ourselves at once in the stony bed of the Wadi Tyin. To our right, some little distance up the ravine, is a village called Baad, which is the highest settlement belonging to the Tyin tribes; but the source of this wadi is at Rautha, further south.

Beneath us now lay stretched, in all its picturesque beauty, one of the largest, most beautiful, and most populous valleys in Oman, the Wadi Tyin, a broad, straight vale lying between two mountain ranges, and extending north-west and south-east for a distance of nearly 25 miles. This rich oasis contains twenty-nine villages belonging to the Rehbiyin, Beni Arâba, Siâbiyin, Nahaya, and Beni Battâsh tribes, embosomed in dense palm groves, with orchards and fields of varied cultivation. Many of these settlements are concealed in the secluded and secure ravines which deeply gash the mountain slope on either side of the valley, but many others extend along the fertile bed, their orchards and plantations fringing the oasis at intervals for miles. It is watered by no less than 360 springs according to the Arabs, with whom this number is a conventional one, and though it does not possess a

broad continuous river, the supply of water in the bed is perennial and abundant, flowing sometimes on the surface, sometimes disappearing in the porous soil. The northern of the two ranges holding Wadi Tyin between them is known in the valley by the name of Jebel Beida, or the White Mountain. It is tabular, and appears to be mainly composed of limestone in horizontal stratification, the average height being perhaps 3000 feet. Arid and sterile as these hills look, they are nevertheless inhabited by a considerable population of shepherds and goatherds, who rear large flocks. Their dwellings are mere oval shanties constructed of loose stones, and they subsist on the flesh and milk of their animals, cultivating only a few vegetables and indigo, which is in extensive demand in the valley. The crevices and hollows in the hills produce an abundance of thorny undergrowth and coarse herbage, from which the goats manage to extract food and nutriment in the most inaccessible spots. But the botany here and throughout the hilly districts is decidedly limited in character, and there is no great variety of species; indeed, the French botanist, Aucher Eloy, reckons that the total number of species in Oman does not extend five hundred. The usual vegetation here consists of colocynth, rue, acacia, vera and arabica, aloes, calotropis, senna, liquorice, euphorbia, brambles, sidr or rhamnus, and others. The wild animals are the ibex, called wail of the Arabs; the wild goat recently identified by Mr. Oldfield Thomas, and named after its discoverer, Dr. Jayakar; hares, foxes, hyenas, etc.

The range on the southern side of the Wadi Tyin is known to some as Jabel Hallowi, to others as Jebel Sauda. This range forms a minor spur from the great chain striking off near Zikki. Its mean height appears to be about 2000 feet, and it has no peak of any great altitude. On the southern flank, which merges gradually into the desert, it throws out several large shallow watercourses, such as the Wadi Andam, Wadi Beni Khalid, and Wadi Halfain, all flowing to the sea south of Ras al Had. The dwellers in this favoured vale, the Wadi Tyin, have made the most of the natural advantages and capabilities of their rocky home, and have, with the indomitable energy and perseverance of the Arab character, industriously laboured to produce all that the fertility of the soil, conjoined with warmth of climate, is capable of. In addition to the usual grains and vegetables raised in Oman, they cultivate kumkum or turmeric, sugar-cane, bastard saffron, and henna. But it is to fruit culture that the Arab specially devotes his attention. The date, the most characteristic tree of Eastern Arabia, ranks, of course, first, and the vast assemblage of palms in this valley is very striking. Vines, peaches, apricots, custard apples, guavas, figs, pomegranates, plums, limes, sweet limes, quinces, oranges, bananas, citrons, mangoes, melons, and mulberries are also cultivated, and with considerable success.

We now pass, at a rapid trot, several villages in succession, each

embowered in an umbrageous date grove, the water here perennially flowing in a copious stream. The first village is Al Bir, with a watch-tower perched on an eminence commanding an extensive view down the valley, and having an aqueduct raised on stone pillars crossing the road. At this point the valley is 1900 feet above sea-level. Nestled in a corner is a town called Miss, inhabited by the Beni Jabir, with beautiful orchards, and enshrined in a little forest of date-palms, which rear their graceful crests over it as if to shade it from the scorching rays of the sun. As our guide, Shaikh Nasir, belonged to this tribe, we were heartily welcomed by the people, and invited to stop, but this I was obliged to decline.

Almost adjoining it is another town with a good cluster of houses, and possessing a masonry aqueduct built up 20 feet above the bed of the wadi to feed the palms and cultivation, a work of considerable pretension for such a place. We halted at Sibal, a fine, large village some miles further on, with an abundant supply of water, and every kind of fruit growing in the gardens. The venerable and courteous chief of this place, Shaikh Mesud, who had met us on arrival, furnished me with a comfortable hut to lodge in, and after we had sat together for a little time to drink coffee, took me for a walk round the town. There are some substantial houses in it, four mosques, and several *sablahs*, or meeting-places. The shaikh pointed out Akabat Amda, which bears a little to the north-east, and informed me that another pass called Akabat Mankal lay almost opposite Sibal and eastward of Amda; he said it was steeper than the Kahza, and was formed by two ravines, viz. Wadi Tima, running into Wadi Tyin, and Wadi Sarreya, on the Kuryat side. The shaikh was acquainted with three roads leading from Wadi Tyin to Al Sharkiya, two of which branch off from Malhalhah, and one from Gubra el Tam. There is much traffic between Al Sharkiya and Maskat by these passes, the roads converging at the Akabat Amda on the northern range, which forms the most direct passage.

In other parts of Oman I had found that certain tribes, particularly those who possessed large herds of camels and droves of asses, had obtained, in the course of ages by length of usage, peculiar privileges throughout the country as carriers of merchandize, but in this valley I could hear of no tribe that could boast of this privilege; all the traders, pedlars, and peripatetic vendors of goods being Mekrani Beluches, who act as agents or travellers for the Hindu and Khoja merchants of Maskat and Kuryat, the latter never venturing to penetrate into the interior of Oman themselves. Collecting from the various settlements in the valley and adjacent parts, the fruits and other produce of the soil, these Beluches bring back in return the sugar, oil, cloth, metals, and other commodities required by the people, though the large Arab proprietors have, of course, direct transactions with the Banians.

The name of this place is suggestive. In the Omani dialect, Sibal means an ape or monkey, and it was the name of a famous idol worshipped by the Arabs in pagan times before Islam. As there are no monkeys in Oman, it is possible that here in ancient days stood a temple dedicated to that image.

Sibal is 1500 feet above the sea, and is distant from Al Wasit about 13 miles. The journey hence to Ghubreh el Tam took us five hours, the distance being about the same, and the aneroid showing a fall of 500 feet in elevation.

From Sibal to Ghubra el Tam the valley continues to present the same character as in its upper part, occasionally contracting and expanding, but on the whole widening considerably as we proceed eastwards, while the hills on either side maintain their altitude. Water is abundant everywhere, in pools and in motion, and many streams pour down from the hillside to swell the volume of the main torrent in flood-times. We pass many villages on our way, cultivation and palm groves alternating with desolation and arid rock. Two of the settlements of the Beni Battash, Hidda and Akdah, are so close together that they form but one large town extending for upwards of a mile, picturesquely flanked by two lofty watch-towers, which command the approaches and guard the water-supply. We were riding slowly and peacefully past Akdah, when our advance was suddenly and unexpectedly challenged by the inhabitants, who, either from panic or some other cause, gathered on the road in front of us in great excitement and offered to bar our progress, firing their matchlocks in the air and brandishing their spears and swords frantically, as if we deserved instant annihilation. This insult on the part of the people greatly provoked Seyyid Nasir, who abused them roundly, and could not conceal his vexation. However, it soon appeared that the noisy demonstration was not of an alarming nature, and as the shaikhs and elders of Akdah used their efforts to quiet the mob, the storm was soon over, and we proceeded quietly on our way. I did not mention the incident to the Temima of the tribe, Shaikh Shamas, when we met next day, but he heard of it from others, and was greatly ashamed of his people's conduct. He apologized to us for it, and announced his intention of punishing those concerned, but I doubt if he possessed the power of doing so.

The town of Ghubra el Tam is very picturesquely situated on the skirt of an eminence, which, lying at the end of the valley and thus forming a barrier against the onward progress of the stream, has caused it to swerve to the northward and cut its way through the mountain range down to the sea. It has some good houses and a population of over a thousand of the Siâbiyin tribe, and is protected by a strong fort of oblong shape perched on the western extremity of the hill.

At this time there was very little water in the wadi, the unusual

dryness of its bed being due to the severe and long-continued drought, from which this part of Oman had been suffering, and our party were congratulating themselves on having arrived at such an opportune time for passing through the gorge, when their joy was suddenly turned into dismay by a slight shower of rain which fell in the evening. The clouds now began to gather so ominously in the sky, that if it had not been so late I should have pushed on at once without halting. It had, however, already become too dark to permit of this, and with some foreboding—for the intensity of the heat seemed to threaten a thunder-storm—we took up our quarters for the night in the habitation our hosts the shaikhs of the town had allotted to us. Had it rained heavily, as many of us fully expected, I should have had to wait here until the torrent had subsided sufficiently to allow of our proceeding through the gap, which would undoubtedly have entailed a delay of several days.

The exploration of this cañon had been one of the main objects of my journey, as it had not before been traversed by a European, so I was resolved to seize the present chance of visiting it at all risks. Fortunately, the night passed without the expected downpour, and though the morning of the 16th broke gloomily and lowery, the rain still held off, and the stream flowing at our feet had risen but slightly. After a consultation, we deemed it best to face the peril of a sudden rush of water through the gorge, and hazard the passage before the storm, which now appeared inevitable, could burst upon us and unite the rills and streamlets of the valley into a swift and overwhelming torrent. Having hastily loaded the camels, therefore, we started early, and crossed the bed of the wadi, in which the water was running a little over 2 feet deep, just opposite the town. We then found ourselves at once at the entrance of the great cleft, which is as sharp and abrupt as if we were entering the portals of some monstrous castle and stood immured within its massive walls. Towering loftily, sheer and perpendicular above the narrow floor, the huge walls of rock give the appearance as if the mountain range had been suddenly split in twain from the base to the summit by some convulsion of nature, exhibiting a singular illustration of impressive grandeur. The breadth of the passage here is about 100 yards, but it varies throughout its length from 500 to 150 yards, while the cliffs rise to an altitude of from 1000 to 1500 feet, as near as I could judge. The stream appeared to flow 4 or 5 miles an hour, and gradually increases in volume as we progress, being fed by the springs of water which burst from the crevices in the walls. Throughout the chasm the camels were wading nearly up to their knees.

After riding along this grand and curious gallery for a quarter of a mile, we are told to dismount, having arrived at a sort of deep step or waterfall called the Akaba. Here the camels are relieved of their baggage and saddles, and are taken along a ledge of the precipice on the left bank which leads circuitously to the bed further on, while the

men of our party are let down by a rope over the projection on to the floor of the wadi below. This remarkable step or fall in the rock offered a very serious impediment, as it was of considerable depth, while huge blocks and fragments of blue and white limestone, that had fallen from above, added to the difficulty, and presented an obstacle which was absolutely insuperable to the camels, even when freed of their loads. The path leading to the fall, along which we had to scramble, was so rugged and slippery, and the cliff was so smooth and waterworn, that even the Arabs, who are as nimble as cats, did not find it easy work.

The solicitude evinced for my safety, not only by my own party, but also by the Siâbiyin who had accompanied us from Ghubreh, was almost touching, though the descent could not in fact be called perilous. Indeed, throughout my excursions in Oman, I always had reason to be grateful to the Arabs of my escort, and not unfrequently to the local Arab shaikhs, for their zeal and self-sacrifice on my behalf. They never resented the inconvenience and fatigue I often caused them, but deferred without question to my wishes as to the when and the whither; while on any occasion of unusual toil or danger, they seemed to regard my safety and comfort as a main point of consideration.

At the bottom of this pass, called Al Makuba by our Siâbiyin guides, we waited an hour for the camels, which, though carefully led by the drivers, did not traverse the narrow and dangerous ledge on the other bank without serious difficulty and hazard. Fortunately, however, they arrived at last in safety, and the baggage, which had in the mean time been lowered down by the Arabs, having been replaced, we mounted and resumed our journey.

The channel is here at its broadest, but it narrows further on, and becomes gloomy and cavernous, the mountain frowning above to a height of about 1500 feet. The cliff on the right bank at this part is known as Hail el Kebir, that on the left as Hail el Harim. Winding along this stupendous chasm, we occasionally have to encounter immense fragments of rock, piled in confusion on the floor, and obstructing the road, while above us are to be seen curious crags, overarching rocks, and other peculiar features of natural architecture. There is no lateral opening throughout the entire length, and only one small ravine falls into it, this being on the left bank. The geological structure of this range, as disclosed by the walls of this chasm, is mainly limestone, superimposed, probably, on the plutonic formation of which the rocks at Maskat are an outcrop. The lowest stratum to be seen is conglomerate, the upper layer of which is arenaceous. Overlying this with a horizontal stratification are courses of limestone, white or blueish, the upper rocks appearing to be of a reddish colour.

As may readily be supposed, the heavy and tumultuous torrents that frequently sweep the bed preclude the possibility of trees and plants

surviving the rush of water, and we consequently find here no vegetation whatever. Even the long period of three years that had elapsed since the last flood had not produced any sign of bush or reed that I could see.

After heavy rain, the volume of water flowing through this chasm must be enormous, and the surging and raging torrent must then be a magnificent sight. It not unfrequently happens that travellers and caravans coming from Kuryat are engulfed and overwhelmed by the sudden rise and rush of the stream, as the innumerable tributaries and affluents in a drainage-area of some 200 square miles, swelling after rain, would concentrate at the gorge with marvellous rapidity and force, and form a mighty and irresistible wave, destroying everything in its path.

This effort of nature to provide an outflow for the pent-up waters of the Tyin valley through a mountain range is the most singular specimen of earth-sculpture I have seen in Arabia, and consists, in short, of a narrow, winding, vertical-sided gallery or cañon, extending for about 6 miles in a north-east and south-west direction, excavated through the solid limestone rock by the erosive action of water in a period of countless ages.

The peculiar character of this chasm, and the grand and picturesque scenery of its surroundings, create an impression on the mind which is not easily effaced. The Arab name for it is the Wadi Thaika, meaning the "Strait or Narrow Torrent."

It was one o'clock before we emerged from the cañon, our rate of progress in it being necessarily slow, and we found the opening at this end less abrupt than at the other, the walls gradually receding on each side and declining in altitude as we proceed. The high point of the range known as Kuryat peak to navigators, and to Arabs as Jebel al Zatri, now lies to our left, and raises its head 6200 feet above us, falling in terraces to the plain, while the mountain cliff to our right over Dagmar has been reckoned at 4000 feet.

Winding round a low hill, we come all at once upon the town of Mezâra, the chief settlement of the powerful Beni Battash tribe, surrounded by thousands of date-palms, rearing their tufted heads in a dense grove; and so sudden and unexpected is our appearance, that no little commotion is caused among the inhabitants, who fly to arms, and rouse themselves into an absurd fit of excitement. Much firing and shouting ensues, but the hubbub evaporates on the appearance of Shaikh Mohammed Adi, who holds this part of the town, and who is most pressing for us to be his guests and remain the night.

But Seyyid Nasir whispers to me that the two shaikhs are not on good terms, and suggests the expediency of moving on to the castle. We accordingly politely decline Shaikh Mohammed's invitation, and ride up to the spot where Shaikh Shamas bin Mohammed, the temima or paramount chief of the tribe, is awaiting us.

I had known this venerable and noble-looking shaikh for many

years, as he often came to Maskat, and I had learned to like and respect his character. His reception now was most cordial, and I was much gratified at it, as it greatly increased the pleasure I felt at being able to pay him a visit in his own home. As we halted and dismounted on the bank of a small but rapid stream that intersects the plain and winds among the palm groves and settlements, Shaikh Shamas came down from his castle at the head of a long procession of his people, and gave Seyyid Nasir and myself a hearty welcome. With a levity and humour uncommon among Arab shaikhs, who are usually grave and dignified, he put his hands on my throat and declared he would throttle me if I did not promise then and there to spend a day with him and accept his hospitality. There was no disputing with him on this point, so, having been carried over the river by his men, I walked up the eminence with the shaikh and Seyyid Nasir, followed by a dense crowd of Arabs to the fort. Just as we approached it, an old twelve-pounder gun lying unmounted on the ground in front of the gateway was fired off in honour of the occasion, the report reverberating finely among the surrounding hills. From this gateway, and in a higher degree from the roof of the castle, the landscape presented to the view is one of exceeding beauty. The town is situated in a small circular plain, the low hills encircling which, with their dark background of lofty peaks and tabular mountains, render it invisible from the sea, and constitute a natural fortification, giving an assurance of peaceful security. The lower part of the plain is filled up by habitations, plantations, orchards, and cultivation, while standing high on the east side is the castle, square, substantial, and imposing.

The temima took us into his reception-hall, where we sat down to talk while coffee was being roasted, pounded, and boiled at the other end of the room. The interior of the castle does not accord with the pretension of its external appearance, for it is but scantily furnished and decorated, and can boast of but little comfort. Chairs, sofas, and furniture, as we understand it, are not to be found in the shaikh's residence, for the Oman Arab is a plain man, simple in his habits, and free from ostentation; his wants are few, and, however well off he may be, he does not indulge in luxurious sloth, or surround himself with many articles of needless luxury. Even the women's apartments are bare and empty; a carpet, a box of clothes, and articles of domestic use are the only things to be seen. The temima, however, was extremely courteous, and treated us very hospitably.

He informed me that the abutment of the range on the north-west side of the Thaika gap was called Jebel Nuwai, and that on the south-east side was Jebel Naab; the Beni Nuwai and Beni Naab being two of the pastoral tribes who occupy the tableland of these hills, and subsist on their flocks of goats and sheep. These shepherds are probably of mixed Arab and aboriginal descent, and form the main

following in war of the settled tribes in the neighbourhood, of which they are, in fact, the Bedouin portion.

Mezara greatly charmed me by its quiet beauty. The rich orchards and gardens and the rippling brook made the locality very delightful and attractive, and I almost envied Shaikh Shamas his residence in so favoured a spot; but, shut in as it is by hills, I should imagine it to be excessively hot and oppressive in the summer months. Just below the town is an aqueduct on five arches, constructed a few years ago for the purpose of leading water from the stream to irrigate the cultivation. Running into the Thaika valley beyond Mezara is a ravine called Wadi Khabba, with a large village of the same name; and under the lofty cliffs to the south-east of Hail are Wallja and Sunt, the latter belonging to the Sâbiyin tribe.

Good fortune had befriended us in allowing our passage through the dreaded Thaika without being overtaken and submerged by a flood. We had, however, only just escaped in time, as the heavy masses of clouds which had been brooding over us since yestermorn began now to descend in a deluge, and a grand thunderstorm broke upon the hills and valleys.

The rain continued all the afternoon, and was most joyfully welcomed by the Arabs, who naturally looked on our arrival in their town as a propitious omen.

Our departure from Mezara the next day was accompanied by the same demonstrations of friendship as our arrival, and, after taking leave of our hosts, we mounted our camels in the presence of the whole community. For 5 or 6 miles our course led along the bed of the river, which, known above as Wadi Thaika, receives here the appellation of Wadi Hail. The banks near Mezara are about 1000 feet high, and perpendicular, but they continue to decrease in elevation and to broaden out as we advance seaward. Along the left bank runs a fine masonry felej, with shafts to raise the water at intervals, recently constructed to replace an old one built by the sultans of the Yaareba dynasty, two centuries before, and now fallen into decay. It soon leads off northwards to supply the gardens and groves of Hail el Ghâf.

On arrival at the settlement, we were met by Seyyid Hilal bin Said bin Hamad and his two brothers, and were escorted to a building forming a single spacious reception-room, situated in a pleasant garden. Here we sat and rested for several hours, enjoying the fragrance of the flowers and the balmy atmosphere of this salubrious spot.

The Hail el Ghaf settlement is said to have been founded by Seyyid Khalfan Al Bu Saidi, a notable man in Oman in the early years of this century, who took a conspicuous part in cementing the friendship of the English with the Maskat government, he being at that time wali or governor of that town.

Prior to the selection of this locality for building and planting by

Seyyid Khalfan and his family, Hail el Ghaf was merely a patch of elevated ground, partly surrounded by the wadi, and covered with a thicket of acacia trees (ghaf), from which circumstance it derives its name. The land was purchased from the Beni Battash tribe, who, however, retained a portion of it, and still exercise a sort of protection over the place. The benign sway of the Al Bu Saidis, and the liberal manner in which money has been expended, have caused the village to flourish and the population to increase to its present number, about 1200 souls.

Hail abounds in orchards and cultivation, and a vast quantity of fruit and vegetables are sent to the Maskat and other markets. The Arabs are as passionately fond of flowers as they are of strong perfumes, and take great delight, when they can afford it, in horticulture. The number and variety of fruit and flower trees, imported at various periods from Persia and India into Oman, testify to the appreciation by the Arab of these plants, and to the care bestowed on them. The "bostans" or gardens, therefore, as may be supposed, absorb most of the time of the aristocracy of Hail, who seem to take the keenest enjoyment in tending their roses and jasmine, and in spending the livelong day in the shade of their *sablahs* or summer-houses. The most beautiful feature in the vicinity of Hail is a broad, straight avenue of superb mango trees over two miles in length.

At 4 p.m. we started for Kuryat, where I intended to pass the night, and on the way we encountered another thunderstorm and heavy downpour of rain, which drenched us through. It was hailed as a blessing by the Arabs to the parched and thirsty soil, and their loud exclamations of gratitude sufficed to reconcile us to our discomfort. We rode fast to escape the deluge, and covered the 12 miles between Hail and Kuryat in an hour and a half.

I took up my quarters in Seyyid Hamad bin Khalfan's large house, which is fortified with two towers, and here I was detained the whole of the following day by the rain, which fell in torrents and without intermission, much to the delight of the inhabitants, but somewhat to my annoyance, for I had visited Kuryat on many previous occasions, and knew it too well to desire its further acquaintance. This town lies 31 miles south-east of Maskat, and is situated about a mile from the shore, on the maritime plain lying between the great range and the sea. The plain contains about a dozen hamlets, and is intersected by two wadis. It forms an extensive pasture-ground, on which in former days an excellent breed of horses was reared by the inhabitants, who exported them from Kuryat in considerable numbers to Surat to supply the Indian market. Chiefly owing, I believe, to internal dissensions, this trade became very precarious, and ultimately came to an end about two centuries ago. The population of Kuryat is 3000, and it has a good bazaar with several shops belonging to Hindu traders, who supply the settlements in the Wadi Tyin and in the hilly districts

east of Maskat with foreign merchandise, the Wadi Tyin being the main artery through which the traffic between Kuryat and the interior passes. This port and Sur are the Karteia and Tsor, the Carthage and Tyre, of the race whom we know as the Phœnicians, and who, as far back as the time of Solomon, or earlier, had trading-stations along the southern coast of Arabia. They are undoubtedly of great antiquity, and retain their primitive names to this day. Their convenient and important position on the Arab coast just opposite India, must, like Kilhat and Khor Jerama (Corodamon), have led to their early occupation as trading depots by the merchants of those times who were engaged in exchanging the productions of the East and West.

The sun rose on the 19th in a clear sky, and we were soon beyond the outskirts of Kuryat, ascending the Wadi Mijlas, a deep and narrow ravine which leads in a tortuous fashion and in a generally south-west direction to Sawâkin, whither the Wali of Kuryat accompanied us on horseback. Sawâkin is a small and pretty hamlet, and forms a triangle with Hail el Ghaf and Kuryat, from which latter town it is 9 miles distant. Here, enshrined in a fine plantation of palms, is a large house built by Seyyid Said bin Khalfan, who used this charming and peaceful retreat as his country house in the hot weather. After an hour's halt at Sawâkin, we leave the Wadi Mijlas, and, striking off to the west, traverse a rough, desolate, and very broken country, a confused mass of ridges and hillocks of limestone, the strata of which appear to slope generally southwards. We twist and turn along the watercourses, which, adorned with dwarf acacias, thorny shrubs, and jungle herbage, intersect the country.

We pass several villages on the road, Heither, Muntheriya, and others, all belonging to the Beni Wahaib and Beni Hassan; and about halfway to Maskat, Sarraya, a small town of cloth-weavers, is pointed out in a well-watered and fertile ravine 6 or 7 miles away to our left. In the evening we reached Al Hajar, a village in the Wadi Hatat, where we camped for the night. It is a comparatively new settlement, for when I first visited the spot in 1876, the ground was being prepared to receive Busreh date-palms, and a felij, half a mile long, had been projected and commenced by Seyyid Hilal bin Ahmed, who had purchased the fountain from its proprietors, the Beni Wahaib. Though water is very plentiful and the soil tolerably productive, the plantations did not appear to have thriven as well as might have been expected. The felij was destroyed, it seems, by a flood soon after it was completed, and had to be rebuilt, and other causes have combined to retard progress; but, like its neighbour Al Birain, which I have mentioned before, it struggles on, and is fairly profitable to its enterprising founder. Tobacco is one of the chief articles cultivated about here, and is grown for the Maskat market.

The Wadi Hatat, in which we now stand, extends, under its various

names of Wadi Kahza, Wadi Hatat, and Wadi Maih, from Jebel Kahza to Yiti, being joined on the way by the Wadi Amda and numerous other ravines. At the foot of Wadi Kahza the hills open out, and a small plain is formed 9 or 10 miles long called Seh Hatat, which has been the scene of many a sanguinary battle in Oman history. It contains several villages and much cultivation, and is possessed by five tribes, viz. the Beni Wahaib, Beni Hassan, Beni Jabir, Beni Battash, and Al Maashera.

The range to our left, on the other flank of which runs the Wadi Tyin, and to which the Rehbiyin and Siâbiyin tribes gave the general name of Jebel Beida, is not known by this name to the Beni Wahaib, who, indeed, could give me no appellation for it.

The Wadi Maih, which extends from Al Hajar to the sea at Yiti, is a narrow vale about 9 miles in length, with a rough stony bed and a fast-flowing stream of water, in which the fragrant and ubiquitous oleander is extremely abundant. It is in general barren, with occasional patches of cultivation. The hamlets in it are Al Mezra Alowi, where the orchards are walled or revetted up on the banks to preserve them from the encroachment and rush of the torrent; then El Mezra Sifala, then Rijaa, and then Yiti.

The geology of the Hatat valley is extremely curious and interesting, as it exhibits on the one hand the nature and stratification of the sedimentary rocks, of which the great mountain chain of Oman appears to be principally composed; and on the other, the metamorphic or igneous structures forming the dark group of hills at Maskat. The bed of the Wadi is throughout of limestone pebbles, underneath which is a coarse conglomerate. The hills are most varied in colour, and the strata lie at all angles.

In the Seh Hatat there are many curious natural pillars about 25 or 30 feet in height, standing some distance apart, and apparently the effect of denudation, the general aspect of this plain suggesting the idea that it may have been in remote times the basin holding the drainage of the surrounding hills in the form of a lake, until the eroding action of the water had excavated its way through the Wadis Maih and Adi down to the sea.

Near Al Hajar the limestone rocks were of a reddish tinge, and appeared to be mixed with layers of blue mud.

In the Wadi Maih the mural section shows the plutonic action in a most unmistakable form, the rocks being all confused and crumpled up, and the strata lying in folds or arches, as it were, over huge blocks of limestone.

We left Al Hajar the following morning, and pursued a course varying from north-west to north. After passing Al Birain, we enter abruptly the defile of Wadi Adi, and then, turning down the Seh Harmal, we soon arrive at Muttrah.

DR. JOHN MURRAY ON THE MARINE FAUNA OF THE KERGUELEN REGION.

In prompt fulfilment of the oft-repeated promise that the 'Summary of Results' was not his last word about the *Challenger* Expedition, Dr. John Murray publishes in the *Transactions of the Royal Society of Edinburgh* (vol. xxxviii. pt. 2), an elaborate discussion of the deep and shallow water fauna of that part of the Great Southern Ocean which lies to the south of the Indian Ocean. The facts concerning the zoology of this area, called for shortness the Kerguelen Region, are almost wholly derived from observations made by the *Challenger* during her brief reconnaissance in higher southern latitudes in the early part of 1874, and Dr. Murray's work impresses us at the outset with the enormous wealth of scientific result he has obtained from what was at best a mere dip into a region of the globe still almost wholly unexplored. The paper consists chiefly of a masterly treatment, by statistical methods, of the lists of genera and species obtained within the area, in such wise as to bring into striking prominence certain remarkable features of the distribution of various forms of life; and these, again, are compared with results obtained by similar methods for other meridians in the same belts of latitude. Prefixed to the zoological investigation is a review of the present state of our knowledge of the hydrography and meteorology of the Great Southern Ocean as a whole; and a concluding section places the research in its position as a contribution to the early history of the planet, on the lines sketched by Dr. Murray at the meeting of the British Association in 1894.

No argument could more clearly set forth the almost incalculable value to science of the results we may expect to obtain from an exploration of the unknown South, even if the crossing of Antarctica itself should prove impracticable, and the highest latitudes remain untouched. And at a time when some attempt seems likely to be made actually to begin the colossal task, no clearer or more authoritative statement could have laid down the actual lines of the work to be undertaken in order to ensure results of the maximum value. If the proposed German Antarctic expedition makes Kerguelen island its head-quarters, as is contemplated, Dr. Murray's paper will greatly lighten the preliminary labours of its scientific staff, inasmuch as the great points at issue, raised by the few observations already extant, are perfectly clear, and no doubt can remain as to what is to be done.

The Great Southern Ocean, constituting nearly one-fifth of the total water surface of the globe, is a practically continuous belt surrounding the world between 40° S. lat. and the Antarctic Circle. So far as is known, the bed of this ocean shoals gradually towards the Antarctic continent, with shallow plateaux in places, as around Kerguelen, and hollows like the Ross Deep and Barker Basin, but nothing of the nature

of an enclosed submarine basin, like the Norwegian Sea of northern latitudes. The most southerly soundings of the *Challenger* show that in the higher latitudes the bottom is covered with a deposit of blue mud, in which are embedded many rock fragments—detrital matter from Antarctica, whereof the lithological character indicates that it came from a true continent, and not from a group of volcanic islands. The blue mud probably forms a belt 200 miles in width around the entire continent; north of it is found diatom ooze, which extends in places up to 40° S. lat., but is usually replaced about the fiftieth parallel by globigerina ooze. The blue muds with rock fragments indicate a sea much frequented by icebergs. The diatom ooze shows the presence of surface waters of low temperature and salinity, and the globigerina marks the transition to the warmer waters of a temperate zone.

The climate of the Great Southern Ocean is controlled by a belt of low barometric pressure, extending right round the globe between 40° and 60° S. lat. Direct observation does not as yet take us beyond this latitude, but there is every reason to suppose that a vast anticyclone rests over the Antarctic continent, and the brave west winds are therefore probably fed by the outflowing air from the high-pressure belt at the root of the trades on the one hand, and from an Antarctic anticyclone on the other. The result is a system of permanent winds of extraordinary intensity, and at the surface of the sea a series of well-marked drift-currents are produced, the circulation of water being the mirror image of the circulation of air. Thus the belt of low pressure, while it delimits one of the great regions of ascending air, marks a region of descending water, and water which under the surface conditions has probably become heavily charged with oxygen in solution. It seems necessary to accentuate the importance of this fact in relation to the broader questions of distribution, in order to urge that any expeditions visiting those regions should be equipped with the means of collecting proper samples of water for the analysis of the dissolved gases. The unusual complexity of the joint effects of temperature and salinity upon the density of the waters, derived by the active mixture of supplies from two sources, suggests that the final description of the circulation will largely depend on the results of analyses of dissolved nitrogen and oxygen. This is distinctly the case in some questions of the mixture of Atlantic and polar waters in the Norwegian Sea, and the absence of submarine ridges, and the greater vigour of the propelling forces at the surface, must make the identification of waters in the Southern Ocean considerably more difficult.

With this introduction, Dr. Murray proceeds to give ten exhaustive lists of marine forms known to occur within the Kerguelen Region of the Great Southern Ocean as above defined, viz. Metazoa procured by the *Challenger* in depths exceeding 1260 fathoms; Metazoa procured at depths exceeding 1000 fathoms, south of the tropic of Capricorn, excluding the

Kerguelen Region; Metazoa procured in depths between 150 and 1000 fathoms in the Kerguelen Region, and in depths less than 150 fathoms; Metazoa recorded as occurring within the Kerguelen Region by observers other than the *Challenger*; identical and closely allied species found in the extra-tropical regions of the northern and southern hemispheres, and unknown hitherto within the tropics; Foraminifera observed in the deposits from the Kerguelen Region at various depths; Radiolaria observed in the deposit and at the surface at *Challenger* station No. 157, in lat. 53° 55′ S.; Diatomaceæ observed in the Kerguelen Region; surface organisms. To each of these lists are appended extracts from the reports of zoological specialists bearing on questions of distribution, and at the end of each is a series of classified lists, which affords means of estimating the probabilities in restricted cases, such as the occurrence of certain species beyond specified limits of area or depth.

Dr. Murray then proceeds to examine the general conclusions as to the distribution of marine life formulated in the concluding volume of the *Challenger* Reports, in the light of the detailed information furnished by the lists. The denial of the old belief in a universal fauna of great age in the deep waters receives full support; and there is further marked confirmation of the result that the marine fauna of high southern latitudes markedly resembles that of high northern latitudes—is, indeed, much more closely related to it than to the fauna of any intermediate region. A further remarkable fact is, moreover, clearly brought out—that in the Kerguelen Region eight hauls with dredge and trawl at depths of two miles yielded 30 more species of Metazoa than are known to exist within 50 fathoms of the surface. The comparative poverty in species of the surface waters in the higher southern latitudes is confirmed by observations in other sections of the Great Southern Ocean. The ratio of species to genera in the shallow waters round Kerguelen (down to 150 fathoms) is 1·74 to 1, little more than half the general average of 3 to 1, and in marked contrast to what occurs in the tropics, as, for example, in the neighbourhood of Cape York. Dr. Murray gives an extremely interesting discussion of this fact, pointing out the great preponderance of animals secreting large quantities of carbonate of lime in the shallow waters of the tropics, and showing how the difference can be explained as a result of chemical rather than of physiological conditions.

Recurring to the remarkable similarity of the fauna of the two extra-tropical regions, Dr. Murray states at length the hypothesis that the distribution of marine life began at the level of the mud-line somewhere about the middle or end of Mesozoic times, when the conditions of uniform climate all over the world came to an end through the gradual shrinkage of the sun's diameter, and consequent unequal heating of the atmosphere. A considerable amount of evidence is brought forward in support of an extremely beautiful theory, to which there

seems to be no *à priori* objection; a theory upon which it would be out of place to offer any detailed criticism until the mathematical physicist decides that its life is to be spared.

NOTE TO SKETCH-MAP OF THE UPPER KUYUNI, BRITISH GUIANA.*

By Lieut. GODFREY-FAUSSETT, R.E.

[The following note from Lieut. Godfrey-Faussett, dated "St. Lucia, W.I., April 2, 1896," will explain the sketch-map of the upper Kuyuni river, published in the present number of the *Journal*.]

"I have the honour to enclose herewith a sketch of the upper waters of the Kuyuni river, British Guiana, from the point (Akarabisi) where it begins to be the present boundary between British Guiana and Venezuela to a few miles above Yuruan. The traverse was taken by me with a prismatic compass last January, when sent up the Kuyuni by the British Guiana Government to Yuruan. The traverse was corrected by observations of latitude and longitude taken some time previously by Mr. McTurk, the magistrate of the district, and a surveyor by profession. It will be seen that the course of the river varies very considerably from the Government map, especially above Ekereku."

THE USE OF BALLOONS IN GEOGRAPHICAL WORK.

By A. BERSON.

At the meeting of the Berlin Gesellschaft für Erdkunde on January 7, Herr A. Berson read a paper on "Geography and Ballooning." The use of captive balloons for obtaining extensive views over unexplored regions becomes greatly restricted in marshy districts, on account of the difficulty of carrying the heavy cylinders of compressed gas, used for inflating the balloons; but wherever river transport in vessels of any size is available, as in the basin of the Congo or Amazon, the question assumes a very different phase. A small captive balloon of about 8800 cubic feet can raise a car containing one or two persons, and enable them, from a height of say 1600 feet, to survey many square miles of country. Still, even in the tropics the loss of gas from a properly made balloon is small, at least during the dry season, and the number of gas cylinders taken need not be large. On board ship, especially in the polar regions, such balloons may be even more serviceable, and it is greatly to be regretted that Nansen was at the last moment prevented from carrying out his intention of adding them to his equipment.

The employment of free balloons for purposes of this kind can only be seriously thought of when the prevailing winds are sufficiently constant to afford a reasonable prospect of landing in a region where provisions and stores can be obtained, or where the expedition can be brought to a satisfactory conclusion. The author, from his experience in thirty-eight ascents at all times and in all weathers, is of opinion that the expedition arranged by Andrée and his companions has little chance of success, and, indeed, is the most risky venture ever undertaken by explorers. He

* Map, p. 576.

agrees with a large number of meteorologists in believing that there is no definite proof of climatic conditions being favourable. We know but little about the winds prevailing between Spitzbergen and the pole, and of the region between the pole and 70° N. latitude—a stretch of about 1350 miles—we know absolutely nothing, either in the direction of Eastern Siberia or North-Western America. It is further obvious that the atmospheric circulation in the belt of moving depressions round the pole cannot be favourable to a journey of from 2000 to 2500 miles. As to the still greater difficulties of practical ballooning, which come first in any question of possible success, the author has found journeys of 180 to 300 miles, with balloons up to 160,000 cubic feet, enormously difficult during rain or snow, and below the rain-cloud level it is impossible to maintain a straight course for longer time. Crossing even a narrow arm of the sea is always difficult; the celebrated French aëronauts L'Hoste and Mangot, after crossing the English Channel several times at its narrowest part, perished in an attempt to reach England from the mouth of the Seine, near Quillebeuf, on a perfectly clear day. The distance direct is only about 80 miles, and in the direction of the prevailing winds, towards Weymouth, 125 miles, but they were never heard of again, although in the most frequented waters in the whole world. In the present state of practical ballooning, Andrée's polar expedition is little better than wilful suicide.

Special departments of geographical science may benefit indirectly by the use of balloons. We can scarcely imagine, for example, a more stimulating and instructive lesson for the student of geo-morphology than a bird's-eye view of a large tract of country, in which he can study at leisure the form and structure of river systems, mountain masses, or depressed areas.

The contributions made to our knowledge of the physics of the atmosphere by the recent balloon ascents at Berlin are of interest to the geographer as well as the meteorologist. Fifty ascents were made in free balloons, and twenty-five in captive balloons, with the primary object of revising and extending the results obtained by James Glaisher thirty years ago. The work developed itself along three lines, corresponding to the chief directions of progress since Glaisher's time. Meteorology has since then been raised to the position of a physical science by the introduction of the synoptic method; the recognition of the fundamental importance of ascending and descending currents has transformed its leading problems into questions of the dynamics of the atmosphere; and last, but not least, improved instrumental methods, founded on truer principles, have seriously modified the results of observation. Geographers and cosmographers are, however, chiefly interested in two atmospheric agencies of the first rank—the motion of the air and its temperature.

The numerous ascents in which observers took part—five over 19,500 feet, one over 26,000 feet, and one over 29,500 feet, the greatest elevation yet attained—have added greatly to our material. We have shown conclusively that the progressive decrease in the rate of fall of temperature with increased height, and consequent approximation to a uniform moderately high temperature at the upper limits of the atmosphere, which was deduced by Glaisher, must be ascribed to defective observation, and chiefly to the faulty protection of the thermometers from the greatly increased solar radiation. Under all conditions and at all seasons, it was found that at high elevations the rate of fall was not only as great, if not greater, than at intermediate levels, but even, for the most part, at the lower levels; and in the open atmosphere, at elevations of about 26,000 feet, much lower temperatures were met with than had been supposed possible since Glaisher's time. At 25,600 feet readings of 35° to 36° Fahr. below zero were recorded, against Glaisher's 4° Fahr. below zero; and at 30,000 feet 54½° Fahr. below zero; giving an average rate of decrease of 0·49° Fahr. per 100 feet, compared with Glaisher's 0·10° Fahr. These

figures agree with the results of experiments recently made in France with balloons carrying self-registering instruments, which gave 90° Fahr. and 101° Fahr. below zero at 49,000 and 59,000 feet respectively; and we are led to surmise that the temperature near the upper limits of the atmosphere must approach much nearer to the absolute zero than has been hitherto believed, the rate of fall in the higher layers answering the so-called adiabatic conditions, which require it to be 1° Fahr. in 182 feet.

Another important result obtained, again contrary to that deduced from Glaisher's defective observations, was that at a height of 16,000 to 20,000 feet the temperature of the air is but little affected by seasonal or diurnal variations, or even by changes in the conditions of weather and cloud; while at 26,000 it is, to a great extent, independent of all these influences. We need only mention, in passing, the proofs of the occurrence of excess of temperature in the middle layers between 5000 or 6000 and 13,000 feet, and of a regular inversion of the temperature gradient in winter and at night, extending to 3500 or even 6000 feet; there is more geographical interest in the information received from the journeys of the "Humboldt" and "Phœnix" as to atmospheric currents. It has come out, in the first place, that the known increase of wind velocity with height is more general and greater in amount than was supposed; and, further, that the frequent exceptions to the occurrence of this phenomenon are apparently limited to layers between 5000 and 10,000 feet, a mixing of currents often taking place at 10,000 to 12,000 feet, although at still greater heights the normal increase is resumed. This increase was at times extraordinarily great, as, for example, in a clear, almost calm September day, when, at a height of 3000 to 10,000 feet, the wind velocity was scarcely 6½ miles an hour; between 13,000 and 20,000 feet it was over 35 miles an hour. The little pilot balloon "Cirrus," which reached a height of between 50,000 and 60,000 feet, covered the distance from Berlin to Jazyny, between Wilna and Minsk, about 566 miles, in six and three-quarter hours, or at an average rate of 84 miles an hour.

The preponderance of westerly winds at high levels, already known from observations of the movements of cirrus clouds, was confirmed; and the deflection to the right, required by theory, was also established, for the pilot balloons showed a course from west to east or north-west to south-east much more frequently than from south-west to north-east, the direction of the prevailing winds at the surface. It was, at the same time, very evident that the amount of the deflection, the height at which it began, and the whole manner in which it took place depended largely on the position of the pilot balloon with reference to the general distribution of pressure. Near an area of high pressure, the wind, blowing gently out of the anticyclone at the surface, increased somewhat in strength, but at an average height of 3000 to 8000 feet it died away altogether, and above that a current from a nearly opposite direction was suddenly entered, which increased in force only slowly until a height of 13,000 feet was reached, and blew towards the centre of the barometric maximum. The inverted exchange of air between cyclones and anticyclones at high levels belongs to this class of phenomena; the inflowing current is already apparent at 6500 feet, and is sharply divided from the outflowing current under it. Within areas of low pressure, on the contrary, after the comparatively rapid variations of the first few hundred feet, the regular deflection in the wind direction comes in only very gradually, and even at great heights the air is still flowing parallel to the isobars or but slightly towards the higher pressures, hence the return current to the anticyclone must apparently, in this case, ascend to much greater elevations. These observations seem to show that the detached anticyclones which disturb the general atmospheric circulation of these latitudes extend to a

much smaller height above the Earth's surface than the vortices of our cyclones, which are, in a certain sense, only secondary offshoots from the great sub-polar depression.

THE MONTHLY RECORD.

THE SOCIETY.

The Society's Educational Prizes.—The following candidates for Queen's scholarships, under the Education Department, were successful at the December examination in obtaining the prizes for proficiency in geography offered by the Society. MALES.—*Prizes of* £2 *each:* Edgar G. Carder, Richard R. Dobson, Fred. Farrar, Robert J. Finch, Stanley R. Hewitson, John S. James, Thomas M. Jeffreys, James Morrison, John P. Mullineux, John Russell, James W. Stokoe, Claude E. Warner. *Certificates:* George A. Barrett, Sherwin Chase, William Chick, George Clark, William A. Cooke, John W. Dean, Charles Frith, William C. Goodson, William G. Hawker, Ernest E. James, William D. Lloyd, Sydney Manion, Walter H. Nickson, Frederick W. Pratt, James H. Sedgwick, William Sedgwick, Douglas V. Sidaway. FEMALES.—*Prizes of* £2 *each:* Amy E. Adams, Alice E. Chapman, Susannah Chirgwin, Florence G. Clark, Margaret A. Hunter, Florence Prescott, Rhoda E. Smith, Eleanor E. Smye. *Certificates:* Lilian M. Cooke, Jessie Harding, Bertha Ward.

EUROPE.

High-level Meteorological Station in the Balkan Peninsula.—The meteorological service organized in the Austro-Hungarian dependencies in 1891, which at the end of 1894 had already seventy-seven stations in operation, including three of the first order and six of the second, has received an important addition by the opening of a high-level observatory on the Bjelašnica, a chief peak on the dividing range between Sarajevo and Mostar. The position of the observatory is in lat. 43° 42′ N., long. 18° 15′ E., elevation 6780 feet. This is the first high-level station in the Balkan peninsula, and as it is situated on a "true peak," it may be expected to yield results of extreme interest. From the first year's work, a summary of which is to be found in the February number of the *Meteorologische Zeitschrift*, it appears that one of the chief difficulties to be met is the immense deposit of ice-crystals on the instruments, similar to that experienced on Ben Nevis and on the Brocken. The observatory is in telephonic communication with Sarajevo, 5350 feet below.

The Ship Canal at the Iron Gates.—According to information received from Buda-Pest, the waters of the Danube were admitted to the ship canal at the Iron Gates on March 1. The canal, of which some account has already been given in the *Journal* (vol. i. 1893, p. 243), is cut through the dyke crossing the bed of the river, on the southern or Servian side. Its length is about 2 miles, width 260 feet, and depth 10 feet. The Danube is accordingly henceforth navigable for the largest river steamers, even at its lowest, from Vienna to the Black Sea. The formal opening of the canal for traffic is fixed for September 27, and the ceremonial is to form part of the Hungarian commemoration festival.

The Protection of the Hallig Islands.—The Prussian Government has resolved to begin works for the protection of some of these islands, which act as

excellent breakwaters to the west coast of Schleswig, and the smaller of which are liable to be entirely swept away by violent storms. Dykes, stakes, and bushwork are to be thrown round Oland, Gröde, and Appeland, and Oland (south-east of Föhr) is to be connected by an embankment on the one hand with the mainland, and on the other hand with Langeness. The works are expected to cost £66,000, and to be completed within five years (*Petermann's Mitteilungen*, 1896, part ii.).

ASIA.

The Mouths of the Siberian Rivers—Explorations in 1895.—The work of the Siberian hydrographic expedition, under Colonel Vilkitzki and Lieut. Ivanoff, during the past summer, as appears from a paper just published in the Russian *Official Messenger*, was most successful. The steamer *Lieut. Ovtsyn*, with its sailing barge, *Lieut. Skuratoff*, wintered at Yeniseisk. Coal, for the summer's navigation, had been supplied during the winter in two places: at Troitsk, near Krasnoyarsk, where it was of inferior quality (160 tons, at 42*s.* 9*d.* the ton), and at Dudinka, on the lower Yenisei, where it proved excellent and quite equal to imported English coal, and where, owing to special conditions, the Samoyedes were willing to transport it, so that 350 tons could be prepared (at 40*s.* the ton). On June 25 the expedition left Yeniseisk, accompanied by the steamer *Minusinsk*, under Mr. Wiggins, junior. They explored the not yet surveyed parts of the lower Yenisei, and then steamed towards Cape Mate Sala, which was still surrounded by ice. Passing round the north-east extremity of the Yalmal peninsula, the steamer, with its barge, entered Ob bay, surveyed its eastern shores, which proved to have been previously very imperfectly mapped, and on September 12 they reached Obdorsk, which has now eight hundred inhabitants, and is rapidly becoming the centre of the whole region. Entering next the Irtysh, they went to Tobolsk, where the steamer was left to winter, as it is proposed to resume next year the exploration of the Ob. The explorers came to the following important conclusions:—The difference between high water and low water in the Yenisei, which attains nearly 3 fathoms at Yeniseisk, goes on decreasing in its lower course, and ceases to be felt in the Brekhovskiye archipelago. The same is true of the rapidity of the current, which attains 5 knots in the narrow upper parts of the river, but decreases in its lower course to three-quarters of a knot, while at the flow of the tide it falls to a quarter of a knot only. In its lower parts, the bed of the river is sufficiently broad to be navigated as far as Turukhansk, *i.e.* for 670 miles, without a pilot. With a pilot, ships having a draught of from 20 to 21 feet can navigate as far as the rapids (1000 miles from the mouth); while in the spring a 4 fathoms' depth is found all the way, nearly up to Yeniseisk. It appears, moreover, that there are no sudden changes in the depth of the estuary of the Yenisei, and that the shoals are all situated along the shores, which are now well mapped—the detailed surveys being based upon accurate astronomical determinations. The eastern entrance to the estuary, on the east of Sibiryakoff's island, has been found safe and easy in all sorts of weather. As to the western entrance, in the west of the same island, its depths also render it safe; but, owing to the high seas running during southern winds, and the fact that shoals spread north of the island, and that they must be passed close by, this passage can be utilized by entering ships only in quite clear weather, while for out-going ships it affords an easy passage in nearly all sorts of weather. This passage, which is shorter than the eastern by 80 miles, has the advantage of offering an uninterrupted depth of 5 to 6 fathoms—where the polar ice does not accumulate—which permits Cape Mate Sala to be reached at a time when the eastern passage is not yet free of ice. As to Ob bay, whose eastern shore was surveyed this year in its northern portion, and the west shore in the south up to Obdorsk, it appears that it is not so wide as is shown on the maps, and that it has

not the straight direction it was supposed to have. Under 72° N. lat., the eastern coast suddenly bends to the west, and runs for 45 nautical miles westwards. Under the 71st degree it turns again eastwards, and only then runs due south, the errors of our best maps in the position of the coast attaining as much as 30 to 35 nautical miles. Moreover, the error in the position of the cape at the entrance into the Tazov bay proved to be 55 miles. This circumstance explains the loss of the steamer *Louisa* and the schooner *Moskva*, as they sought escape from storms in Tazov bay. The depth of Ob bay, if one steams in sight of the shores without approaching them, is from 6 to 12 fathoms. Sand-shoals were only met with in proximity of the western shore (on one of them the schooner *Tumen* perished in 1879); but the seas run so high that it is much more difficult to struggle against them in this bay than in the estuary of the Yenisei. During a southern storm, experienced near to Tazov bay, the *Lieut. Ovtsyn*, torn from its anchors, was so balanced that the inclination of the steamer attained over 40° on each side. The water of the bay is sweet, and, contrary to what is seen in the Yenisei, very muddy. The banks are marshy, and there is no floating timber along them. Nor is there any tree vegetation, the northern limit of the same being situated much more to the south than is the case on the Yenisei. The first bushes on the Yenisei are seen at Lukovaya, in 70° N. lat.; while in the Ob bay bushes appear only in the Khamanel Ob, under the 67th degree. No human beings were met with in the whole length of the bay, *i.e.* a length of 670 miles. The first fishers' huts and Ostyak encampment were found in the Khamanel Ob, which is covered with islands, and upon which navigation is consequently safe. Further details concerning the Ob itself may be omitted. It must be added, however, that an officer of the expedition, M. Botkin, M.D., has made very interesting natural history collections, especially of the fauna of the two bays. Nordenskjöld has, of course, explored the Siberian arctic fauna, but his dredgings were chiefly made in the salt ocean water, while the expedition chiefly dealt with a mixed fauna, and could ascertain how far the marine fauna penetrates into the two bays. The collection, now in the hands of specialists, is said to contain a considerable proportion of quite new and interesting species.

The Anglo-Afghan Frontier Agreement.—The agreement between India and Afghanistan concluded on November 12, 1893, and popularly known as the "Durand Agreement," has been published in the recent Chitral Blue Book. It consists of seven clauses, most of which are purely geographical. Clause 1 provides that the eastern and southern frontier of his Highness's dominions from Wakhan to the Persian border shall follow the line shown in the map attached to the agreement. Clause 2 provides against interference by either government in the territories beyond the line. Clause 3 provides for the retention by the Amir of Asmar and the valley above it as far as Chanak. His Highness agrees not to interfere "in Swat, Bajaur, or Chitral, including the Arnawai or Bashgal valley." Birmal is ceded to the Amir, who gives up, on the other hand, the rest of the Waziri country and Dawar, as well as Chageh. Clause 4 directs the demarcation of the frontier wherever practicable and desirable by joint British and Afghan commissioners, "whose object will be to arrive by mutual understanding at a boundary which shall adhere with the greatest possible exactness to the line shown in the map attached to this agreement, having due regard to the existing local rights of villages adjoining the frontier." Clause 5 records that the Amir withdraws his objection to the new British cantonment of Chaman. It also provides in detail for the tracing of the frontier line near Chaman. Clause 6 is of a general character, and Clause 7 permits the Amir to purchase and import munitions of war, with the additional stipulation that the Government of India will give him some help in this respect, and it also increases the Amir's subsidy

from twelve to eighteen lakhs of rupees. The above agreement has, however, been revised, and the revision will be laid on the table of the House of Commons. On April 16, Lord George Hamilton, in reply to Sir Charles Dilke, explained that though the Durand treaty provided for the whole of the Arnawi-Bashgal valley remaining in the British sphere, yet, when the delimitation began in the field, "it was found that the Bashgal and Arnawai ran in different directions, the Arnawai draining into the Kunar from the east, and the Bashgal from the west. The frontier was therefore revised, and the revision placed within the sphere of influence of the Amir the Bashgal valley, which is west of the Kunar river, and over which the Mahtars of Chitral have claimed rights. This included part of the country visited by Sir G. Robertson in 1890 and 1891." It will be apparent, on a close examination of the case, that Lord George Hamilton's statement, assuming it to be correctly reported, is not clear; in fact, it seems based on inaccurate topography. The Arnawai valley cannot, in the light of all our published information, be said to "drain into the Kunar from the east." No doubt some modifications in its course may have been revealed by the operations of the demarcation surveyors, but Mr. McNair and Colonel Woodthorpe's information shows clearly that the Arnawai valley lies west, and not east, of the Kunar river. We understand that the government are in possession of no actual survey of the Bashgal valley, and that the information as to its being distinct from the Arnawai was derived from the Amir. The point of the cession of these valleys is of political importance, as it was through the Bashgal valley that one of the Amir's armies recently invaded Kafiristan, and in the future it will form the principal access to the country from the British side.

The Afghan Campaign against the Kafirs.—A correspondent writes to us: "The letter from Miss L. Hamilton, M.D., in the *Times* of April 4, giving particulars of the Afghan campaign in Kafiristan, is exceedingly interesting, but, owing to the absence of any good map of the country, it is difficult to identify the names of the places. The best map I have yet seen is that prepared to illustrate Colonel Tanner's paper in the *Proceedings of the R.G.S.* for May, 1881. The discovery of the actual memorial tablet of stone erected by Timur in 1398 A.D., with the inscription commemorating his victory over the Kafirs in that year as narrated by Abu-l-Fazl, is a most remarkable and gratifying link with past history. The facts of Timur's invasion are given at p. 135 of Major Raverty's 'Notes on Afghanistan,' which it would be worth while for your readers to glance at. And this brings me to a suggestion which I respectively commend to the attention of your readers and of the Royal Geographical Society. Could not a map be prepared to accompany Major Raverty's remarkable work? At present the value of this voluminous and important book, with its innumerable routes and topographical data, is seriously diminished by the absence of a good map with the names of places spelt in Major Raverty's well-known system of rigid orthographical accuracy. As in every case, I believe, the orthography is in accordance with the true written form of each word, it may be assumed that such a map would be a great help to the Indian Intelligence and Survey Departments, and perhaps the India Office might be disposed to co-operate with the Society in its production."

The Ethnography of Caucasia.—The very great variety of races and stems which have settled in the highlands of the Caucasus during the great migrations, and inhabit them up till now without mixing, is well known; and it was for a long time the ambition of ethnographers and geographers to first establish an appropriate classification of these different populations, and next to determine the numbers of each of them and their geographical distribution. The first part of this task has mainly been accomplished through the linguistic researches of the late Baron Uslar and his follower, M. Zagursky. As to the second part, the detailed

lists of the families in all the villages of Transcaucasia, which were made in 1886–91, give the necessary materials. Now, the results of these researches have been embodied by E. Kondratenko in a series of maps of the different provinces of Russian Transcaucasia (Tiflis, Kutais, Erivan, Kars, Elisabethpol, Baku, and Daghestan), on the scale of 20 versts (13 miles) to the inch, upon which all the different races and stems are represented by different colours. The maps, in the shape of a folio atlas, are given as a supplement to the eighteenth volume of the 'Memoirs (*Zapiski*) of the Caucasian Geographical Society.' Each village community having been mapped separately, and the boundaries of each village's territory being given on these maps, one sees on them at a glance the ethnical composition of the population, as well as the degree to which different populations are interwoven in each part of the territory. At the same time, on the margins of each map one finds the numerical composition of the population of each separate town, while two other coloured diagrams give the items of population of different nationalities in each of the districts (*uyezd*) into which the provinces are subdivided, and the totals for each province. The classification of the different nationalities of Transcaucasia being the fruit of very careful linguistic investigations, it is well to notice it in this place. The Indo-European or Aryan family is, of course, represented by the Slavonians, Germans, Romans, Pelasgians (Greeks), Iranians (Ossetes, Persians, Tates, Talyshins, and Kurds), Armenians, and Hindus (Tsiganes). The Semitic family includes the Jews and the Aisores. Next come the Caucasians proper, divided into several groups: the Kartvelian group, that is, the Georgians proper, with their numerous sub-branches—Tushins, Pshaves, Khevzurs, Mtiuletians, Imeretians, Gurians, Ajars, Enghilois, Mingrelians, Lazes, and Svanetians. The mountaineers (*Gortsy*) are divided into two groups: the western mountaineers (Abkhazians, Cherkesses, and others), and the eastern mountaineers (Chechens). Next comes a great subdivision, including the Lezghians, which comprises the following groups: the Avaro-Andian group, the Darghi, the Kyurin, and the Udin groups, as well as a group of smaller stems (nearly ninety-seven thousand souls), whose affinities with the Lezghians are not yet fully established. All these belong, of course, to the White race, but Transcaucasia has also among its inhabitants the Yellow race, in which the Caucasian ethnologists include the Turkish stem: the Akzerbijan Tatars, the Turks proper, the Turomanes, the Karapapakhes, the Nogais, and the Kumyks. Finally, the Finnish stem is represented by a few Esthonians. It must also be added that the same volume of the Caucasian memoirs contains a map which completes the above atlas and acquires a special interest at present; namely, a map of Turkish Armenia and Kurdistan, based on V. Cuinet's work, 'La Turquie d'Asie, en 1890–94,' upon which map the percentage of Armenians to the total population of each sub-district (*kaza*) is given in different colours. It is striking to see on this map how extremely small is the territory where the Armenians make more than fifty per cent. of the aggregate population. Only two *kazas* in the north-east and the south-west of Lake Van, out of 148 *kazas* in the eight *vilayets*, are in this case; while even on the west of the lake, where the Armenians are relatively more numerous, they make only from twenty-five to forty-five of the population. With the exception of these two *kazas*, and three others in which the Nestorians or the Greeks prevail, nearly the whole of the map is coloured in dark green (seventy-five per cent. or more of Musulmans), or in light green in the south-east (fifty to seventy-five per cent. of Musulmans). Two papers, in which all numerical data are given in full, accompany these really excellent maps.

A Journey from Damascus to Bagdad.—The third number of *Petermann's Mitteilungen*, 1896, gives the first part of an account of a journey made by Freiherr

v. Oppenheim in the summer of 1893 from Damascus to Bagdad. Beginning with a wide loop through the volcanic region to the south and south-east of Damascus, in the course of which he was able to follow a route not hitherto traversed by any European, namely, that through the middle portion of the Harra, or stony desert, to the east and south-east of the volcanic hills of Jebel Hauran and Jebel-es-Safa. Wetzstein, Graham, the Comte de Vogüé and M. Waddington, and Herr von Stübel had none of them got farther south than the Wadi el Gharz (between Jebel-es-Safa and Jebel Hauran), and Captain (afterwards Sir Richard) Burton and Mr. Drake had been stopped on the southern margin of the former hills. The Harra is composed of sheets of lava that has issued at different times from volcanoes, or flowed out of rifts in the ground without any marked rise of the surface in the neighbourhood. The different sheets can easily be distinguished by their difference of colour or the different degrees of disintegration. The lava is now for the most part broken up into dark brown or black blocks of 30 to 40 cubic yards in size, being only seldom met with in larger compact masses. The undulations of the ground over which the sheets were originally poured can still be seen in the surface of the lava. Between the Harra and the Jebel-es-Safa is a lava-free plain, called the Ruhbe, about 6 miles long by 3 to 3½ miles wide, which in the rainy season becomes almost marshy and yields excellent grain, but in summer is only a bare steppe. In the new part of his route, which began at Salkhad, on the south-east of Jebel Hauran, proceeding thence in a north-easterly direction, Baron von Oppenheim passed through Sali, a town on the east side of Jebel Hauran, once evidently of great importance, in which he discovered some very remarkable ruins—quadrangular towers with chambers narrowing towards the interior, their side walls forming the radii of a circle. Like the Sardinian nurhags, these towers have their outer walls built of large and well-hewn stones in the lower courses, smaller and more roughly cut stones higher up. He then visited Nemara, in Roman times a military post situated on the Harra to the south of the Ruhbe and the Jebel-es-Safa, and thence proceeded north-north-east through the Ruhbe to Jebel Ses, climbing the Jebel-es-Safa on the way. Jebel Ses is the rim of a crater, the interior of which is now occupied by a plain about half a mile in diameter. It looks down on a small plain on the east free from stones, and in winter mostly converted into a lake or swamp. Here fragments of walls and tolerably well-preserved ruins of other kinds bear witness to the former existence of a considerable population in this neighbourhood. There are numerous Sabæan inscriptions, and in Roman times troops were stationed here. Von Oppenheim's southerly loop ended at Dumer, a large village on the edge of the plain of Damascus, whence a route somewhat south of the regular caravan route was followed to Palmyra (Tadmor), now the seat of a mudir. From Palmyra he crossed the so-called Syrian desert by the caravan route to Der (Deir or Ed Deir), on the Euphrates, in five days. Though water is found only at three places on this part of the route, the term "desert" does not properly designate this part of the Syrian Hamad. It should rather be called a steppe, having in spring a rich growth of grass where there is enough water, and being permanently sterile only where the gypsum and limestone, which form the basis of the plain, come to the surface. Within the last few decades Der has been a rapidly rising town, though von Oppenheim considers Cuinet's estimate of the population, twenty thousand, somewhat too high. Its prosperity is due to the establishment of the zaptieh barracks (kishlas) at intervals of a day's journey along the direct route to Aleppo, by means of which that route has been rendered perfectly secure. At a time when we are hearing so much of Turkish misgovernment, it is a change to read of the excellent results of Turkish administration in one part of the empire. Von Oppenheim admits that the last part of the route to Bagdad, that in

Mesopotamia, is still somewhat unsafe, but persistent efforts are being made by the mutessarif of Der to keep the wild Beduin in subjection. Efforts to induce them to settle down to agriculture on the banks of the Tigris and Euphrates have been to a large extent successful. A remarkably beneficent institution is the Ashiret Mektebi, a school at Constantinople for the education of the sons of influential sheikhs from all parts of Turkey, but especially the Beduin districts, founded under the direct initiative of the Sultan Abdul Hamid II., "whose eye is directed to all the possibilities of progress in his wide empire."

M. Chaffanjon's Journey in Mongolia and Manchuria.—The *Comptes Rendus* of the Paris Society (1896, Nos. 1 and 2) contain some details as to M. Chaffanjon's journey, the fuller account of which is given in reports addressed by him to the Ministry of Public Instruction. He had arrived at Irkhutsk in December, 1895, by way of Chuguchak, Kobdo, and Urga, having thus traversed Western Mongolia from south-west to north-east. His chief difficulties had been encountered in the passage of the Altai, where the only routes consist of bridle-paths used by horses or sheep. The few caravans of camels which enter the mountains proceed very slowly, and make immense détours to avoid the summits of the chains. M. Chaffanjon was planning to continue his journey during the present year across Manchuria to Vladivostok by way of the Kerulei-Kiuriulun, Dalai-Nor, and the Khinghan mountains, afterwards visiting the lower Amur and the Pacific coasts for the purpose of collecting specimens of the flora and fauna.

AFRICA.

General Chapman on the Mapping of Africa.—In supplement to the short article in the April number of the *Journal*, it will be useful to quote the following recommendations made by General Chapman, in connection with Mr. Templer Horne's communication: "It will be observed that, for the completion of the present system of triangulation, the co-operation of the Orange Free State will be required; whilst, in order to run the three meridian series and the traverse series of triangles along the eighteenth parallel of south latitude, it will be necessary to apply for assistance both to Germany and to the Transvaal Republic. In this necessity for the assistance of others lies the germ of that united action which it is my earnest desire to see extended over the whole continent of Africa. How this may be ultimately attained is a question which requires much consideration; but it would seem to me that the principal element of success is to be found in the formation of an International Committee. The formation of such a committee, whose members could correspond freely with each other, and meet at stated periods to report progress and exchange ideas respecting future extension, would be invaluable, and, indeed, would appear to be almost a necessity in order to secure harmonious and systematic work. It further occurs to me that, if reports something similar to that of the Surveyor-General of the Cape could be furnished by those entrusted with the survey work in the various African colonies, and if these reports could be submitted to this committee for general consideration, no inconsiderable advantage would be derived therefrom. Possibly, too, the work already done by each country might be plotted on a skeleton map of the continent. This, and the publication by the committee of an annual report, would, I think, be of undoubted value, enabling each country to take note of the progress which had been made by the others, and affording a valuable record on which to build new schemes for extending the work into the interior."

Mount Kenia.—The following communication from Mr. Hardinge, H.M. Agent and Consul-General at Zanzibar, dated "Mombasa, February 29, 1896," has been forwarded to the Society at the request of the Secretary of State for Foreign Affairs: "I have the honour to report that Dr. Kolb, a German explorer formerly

connected with the Freeland Society, has just returned here from Mount Kenia, to the summit of which he claims to have ascended. His route was from Kibwezi *viâ* Ikutha and Kitui across the upper waters of the Tana; and he describes the country as very fertile and populous, and as enjoying an excellent climate. The people inhabiting and cultivating the slopes of Kenia have no common tribal name or government, but are called after their respective districts or villages. They are distinct both from the Wakamba and Wakikuyu, but speak a dialect resembling that of the first of these tribes. He had a certain number of fights with them, but eventually succeeded in establishing fairly friendly relations with them, and in inducing one of their chief medicine men to come down to see Mombasa, so that he may tell his countrymen on his return of the wonders of the coast. Dr. Kolb was enabled to collect some interesting information as to the tributaries of the Tana, and to establish the existence of four of them hitherto, I believe, unknown, or only partially and inaccurately known, viz. (going from south to north), the Tiwa, the Nsua, the Eusui, and the Sungussa, all of which rise in the highlands of Ukambani, and flow in a mainly easterly direction through the barren country intervening between Ukambani and the Galla country to the immediate west of the Tana. This region, which commences on the other side of a chain of hills about 40 miles to the east of Kibwezi, he repeatedly visited, and he describes it as a desert inhabited only by a few Gallas; the Wakamba take nine days to traverse it. I was struck by Dr. Kolb's account of the denseness of the population in Ukambani. He reckons the Wakamba at not less than half a million, and says the German missionaries at Ikutha regard even this estimate too low."

Tripoli.—The following interesting letter, dated "Tripoli (Tarablus el Gharb), March 17, 1896," has been received from Mr. H. S. Cowper: "I have just returned from a visit to the Jafara Tarhuna and M'salata districts of the Tripoli hills. My route on leaving here coincided for the first two days with last year's trip, and I then diverged east, and entered Tarhuna by the Wadi Tergurt (or Ter'gud), running nearly parallel with Wadi Doga. In this wadi, and near its *Fum* or mouth, I found some important Jenam sites, but at one of the most remarkable I was compelled to desist from examination, owing to the very threatening attitude of the local Arabs; this was due chiefly to the existence of *Merabuts* of saints' tombs in the immediate vicinity. My route passed from Tergurt, up Wadi Guman, which joins it, and brought me out close to my camping-ground of March 24 in last year. Leaving this, I rode a day's journey south, and came to the upper part of the Wadi Tergelat, which is south of the Fergana district, and not close to Jebel Nisid of M'salata, as incorrectly placed in the map in my recent paper. The latter is Uani, or Ueni, running to Tergelat. This Tergelat is the most important wadi in the district, and is undoubtedly the ancient Cinyps, which runs to the sea 15 miles south-east of Khoms. Travellers have called it Kaam, which, however, is the district it traverses near its mouth; and others name it Nigar el Grin; but, curiously, the proper name for its whole course, *Tergelat*, has not, as far as I am aware, been noted. I was, unfortunately, unable to carry out my plan of following this important wadi down to its mouth, as my guide considered the lower parts unsafe. I therefore examined the sites in its upper course, in the districts called Ghirrah and Mamura, and then returned through Fergana and Kseia to Jebel Nisid (M'salata); and thence passing south of Kusabat, I reached Khoms. From Khoms I rode to the mouth of Tergelat at Kaam (Kam), and spent five days among the ruins of Leptis. Exclusive of Leptis, I was able to visit about thirty new sites or ruins, of which some twenty were of the Senam type, one or two showing remarkable features. I instituted inquiries in different quarters about the number and lines of the various Tarhuna wadis, and the information obtained

appears considerably at variance with all existing maps I am acquainted with. Numerous compass bearings were taken; and after some difficulty I succeeded in obtaining a complete list of the Tarhuna tribes. These number about thirty-six, but it should be noted that there does not appear among them a tribe called Tarhuna, as is mentioned in some Government reports."

The Mahdist Power on the Upper Nile.—A concise summary of the principal occurrences in the Eastern Sudan since the Mahdist revolt fifteen years ago—especially those relating to the provinces held for a time by Slatin, Luptin, and Emin—is given by M. Wauters in the *Mouvement Géographique* (1896, Nos. 12 and 13). The present position and extent of the Mahdist power in those regions is shown thereby (the latter being illustrated by a map) as well as the extent of the French and Belgian occupation in the regions to the south-west. Especial attention is called in the second article to the way in which the Dinkas on the Bahr-el-Ghazal have succeeded in freeing themselves from foreign dominion, having first, with the aid of the Madhists, defeated the heroic efforts of Lupton to maintain the Egyptian rule; and then, turning against their allies, succeeded in driving them out of the Bahr-el-Ghazal province, which has thus remained in great part outside the Mahdist influence. The possession of steamers on the Nile has, however, given the Arabs the advantage in this quarter, and though, owing to the absence of Omar-Saleh, the expedition of Van Kerckhoven in 1891-92 met with no resistance on the upper Nile, the Mahdists soon took the offensive, and the Belgian posts at Dufile and other places had to be evacuated. The Congo state has now four strong fortified posts on the upper Welle, but, contrary to statements that have been made, holds none in the Lado *enclave*. The French have small garrisons at a few posts on or near the Mbomu, of which the most easterly is at Zemio's, in about 25° 20′ E. long. North of this the Mahdist influence extends southwards to the Nile-Congo watershed.

French Congo.—A useful map of the whole basin of the Sanga as at present known has been published by M. Wauters in the *Mouvement Géographique* (1896, No. 5). Care has been taken to make use of all the material available, particularly that furnished by the Brothers De Brazza, Lieut. Mizon, and MM. Clozel and Ponel, by which the work of the first explorers, MM. Cholet and Gaillard, has been supplemented. The positions of M. Mizon, published lately in the *Bulletin* of the Paris Society, to which allusion has been made elsewhere, have been largely used in fixing the geographical co-ordinates on the Sanga itself; while on the Congo, those of Captain Rouvier, with one by Captain Delporte, have supplied a fixed base to start from. That extensive gaps still remain in our knowledge even of the hydrography of these regions is shown by the fact that the course of the Licona, crossed by M. S. de Brazza in one of his first journeys in the interior of French Congo, has remained to the present day undetermined, it being still uncertain whether it joins the Likuala or enters the Congo by an independent mouth; nothing also is known of the course of the northern or "grassy" Likuala, which flows between the Sanga and the Ubangi. While the generally accepted idea is that the main branch of the Sanga is that formed by the junction of the Mambere and Kadei, both coming from the neighbourhood of Kunde, on M. Mizon's route, M. Wauters shows that the large size of the Goko, which joins the other branch from the west between 1° and 2° N. lat., makes it possible that this is the principal branch, and that it may be supplied by important streams from the north-west (including some crossed by Mizon between Kunde and Ngaundere), carrying the basin of the Sanga further in this direction than has been supposed. M. Wauters also calls attention to the fact that, according to Mizon's positions of Kunde and Gaza, the Cameroons frontier is shifted considerably to the westward,

between 4° and 6° N. lat. The map shows the results of M. Clozel's journey across the watershed into the Shari basin (*Journal*, vol. vi. p. 185), accounts of which have been published (with maps) in the *Bulletin du Com. de l'Afr. Franç.* (1895, p. 245), and in the *Tour du Monde* (1896, Nos. 1–3). After leaving the Sanga basin, Clozel first crossed a river named Bali, still belonging to the Congo basin, before reaching the Wom. This he is inclined to consider as the upper course of the "grassy" Likuala, though M. Wauters prefers to suppose that it is that of the Lobai, a tributary of the Ubangi. The space between the Sanga and Wom is mainly occupied by an extensive plateau, giving rise to various streams. The Wom rises in the group of mountains of Mande, between Kunde and Ngaundere. Where seen by M. Clozel, it had a breadth of about 70 yards, with a depth of 7 feet, quite free from rocks or rapids. As this was in the dry season, he considers that for six months in the year it should be navigable for light-draught steamers.

The Congo Railway.—A recent number of the *Mouvement Géographique* (1896, No. 9) reproduces the most important sections of the report on the Congo railway, issued by the commission appointed by the Belgian Government to examine into the state of the undertaking. The general conclusions of the commissioners are favourable, both as regards the condition of the line already opened, the organization of the traffic, and the progress being made with the portion under construction. It is considered that the present service of trains would suffice for an annual traffic of 30,000 tons. The prolongation of the line to Stanley Pool will not present more difficulties than the section before Palaballa, and there is good reason to suppose that the cost of construction per kilomètre, in which a great reduction has been gradually effected, will not in future exceed 130,000 francs. The line ought to be completed, it is thought, by the end of 1900. In the first number of the *Mouvement* for the present year, M. Jules Cornet, the geologist who accompanied the commission, has given some notes on the features of the country around Kimpesse, to which the works for the railway have now advanced, 160 kilomètres (100 miles) from its commencement. Shortly before this the railway will cross the Kwilu—here 27 yards wide, and flowing between banks 16 to 20 feet high—by a tubular bridge 90 yards long. The river apparently rises at least 10 feet in the rains. Beyond this the line reaches the plain watered by the Lukunga and its affluents, north of which rises the steep escarpment of the rugged plateau known as the *Bangu*, which recalls that of Kundelungu in Katanga.

Captain Bòttego's Expedition.—News of Captain Bòttego's expedition is published in the *Bolletino* of the Italian Geographical Society, 1896, p. 97. It had arrived at Lugh in good condition on November 18, and friendly relations had been established with the natives, although they were found, on arrival, to have retired to the opposite (right) bank of the Ganane. Captain Bòttego was to start for the interior about December 10 or 12.

CENTRAL AND SOUTH AMERICA.

Projected Ship Canals in the United States.—Dr. Emil Deckert gives an account in *Petermann's Mitteilungen*, 1896, No. ii., of four ship-canals, the construction of which is now being advocated in the United States on commercial or strategical grounds, or both. The first of these, the Cape Cod canal, has been in contemplation for many years, but the company which now has the work in hand seems likely to proceed with it more energetically than previous projectors. The route likely to be adopted is only about 7½ miles in length, beginning at the town of Barnstable, which lies on a small sheltered bay in the south of Cape Cod bay, and ending at the Bass river, south-east of Barnstable. It would be without locks, and would be comparatively easy to construct, the only serious difficulties being the removal of the bar at the mouth of Barnstable bay, and the deepening of the

Bass river entrance. As the canal would reduce the distance between New York and Boston from 400 to 250 miles (37 per cent.), and the sea traffic between New York and New England ports amounts to more than twelve million tons annually, it is expected that the canal would prove remunerative. Another project is for the construction of a canal between Raritan bay and the Delaware, which would reduce the distance between New York and Philadelphia by sixty-six per cent.—from 274 to 92 miles. The canal would begin near Sayreville (above South Amboy), on the Raritan river, and, following the depression between the Cretaceo-Tertiary hill country of south-eastern New Jersey and the Triassic-Archæan-Palæozoic highlands in the north-west of that state, would join the Delaware at Bordentown, below Trenton. The depression referred to is nowhere more than 100 feet above sea-level, and is mainly filled with beds of sand, gravel, clay, and marl; but near both ends of the canal three locks would be required, with a rise of 20 feet each. The length of the canal would be 25 miles, and the proposed depth is, for the present, only 20 feet. A third project is for the construction of a Delaware-Chesapeake canal through the root of the Delaware peninsula, below Wilmington. The construction of a canal without locks at this part, where the width is only 13½ miles, would present no serious difficulty, and would reduce the sea distance between Philadelphia and Baltimore from 430 to 112 miles, or by seventy-four per cent. The fourth project is for a Chesapeake-Albemarle canal. This would have a length of about 14 miles, and would be quite as easy to construct as the last-mentioned; but, as it would reduce the distance between Baltimore and Beaufort (N.C.) by only 11·6 per cent. (from 430 to 380 miles), its chief advantage would lie in the avoidance of the dangers of Cape Hatteras.

AUSTRALASIA AND POLYNESIA.

Geological Explorations in the Northern Territory of South Australia.—A report by Mr. H. Y. L. Brown, Government geologist for South Australia, has been issued, describing geological explorations made by him in the northern territory in 1894. The routes followed led from Port Darwin in a variety of directions, both along the coasts and into the interior, and the country examined included the banks of the Victoria and Daly rivers (of the former of which several photographic views are given); the gold districts; the vicinity of the telegraph route as far as Alice springs; and a section between Powell's creek telegraph station and Buchanan creek near the Queensland border. A general knowledge of the geological formations was obtained, and the important discovery was made of rocks belonging to the Carboniferous and Cretaceous series, not previously proved to exist in the country. The Carboniferous rocks are on the coast, and may prove to contain workable seams of coal, and thus be of great importance in the development of the territory. Auriferous rocks were also discovered at the mouth of the Fitzmaurice river. The claims in the gold districts are almost all worked by Chinese, mostly in an unsystematic manner, and the report urges the need of the sinking of deep shafts, with drives and cross-cuts, to prove whether the surface reefs and veins are continued downwards. In the detailed description of the various routes, useful information is given of the general surface features, as well as of the geological structure of the country. This is especially the case in the section dealing with the tableland country between the telegraph line and the Queensland border, which consists chiefly of open plains, with patches of low timber, well grassed throughout. The country had suffered from a prolonged drought, but during the time embraced by the journey a considerable amount of rain fell, making much of the surface extremely boggy and difficult. Blue-bush and gutta-percha trees grow on land liable to floods, which cover large areas in the rains. The record of rainfall kept by Mr. Hutton, manager of the Brunette Downs cattle station,

showed the following results for January and February: January, 15·830 in.; rainy days, fourteen. February, 9·640 in.; rainy days, thirteen. Geological sketch-maps of the various routes are appended to the report.

POLAR REGIONS.

Dr. Nansen's North Pole Expedition.—A Reuter despatch from St. Petersburg states that a telegram received there from Irkutsk says, "M. Skripitzyn, governor of Yakutsk, has communicated to the governor of Irkutsk for publication the following report sent by M. Kazantseff, assistant chief of police, from Ust Yansk, dated March 21: 'The inhabitants of Ust Yansk know nothing with regard to the fate of Dr. Nansen's expedition. The natives who stayed from May to November last year on the islands of Liakhoff and Kotelny, where the stores of provisions organized by order of Baron Toll are deposited, did not see any ship or traces of wreckage in the adjacent seas. M. Kuchnareff (the trader) was not questioned on the subject, as he was away on business a distance of over 1000 versts from Ust Yansk. Persons who know him state that he based his letter on Dr. Nansen's expedition on old newspaper reports.'" Another telegram, dated "St. Petersburg, April 21," is as follows: "M. Kuchnareff, the trader, while passing through Tomsk, is reported to have given to the local gazette the following explanation of the recent reports regarding Dr. Nansen: One of the three parties organized by M. Kuchnareff to search for mammoth ivory in the New Siberian islands returned and reported that they had seen Europeans in the neighbourhood of the islands. No attention was paid to these people, as it was thought that they were engaged on a futile and useless expedition similar to that of the *Jeannette* and others. M. Kandakoff, the police official at Kolymsk, through whom the reports were received, concluded that the Europeans mentioned belonged to Dr. Nansen's expedition. The two other parties of ivory-collectors are expected to return to the Continent in November, and they should be able to give more positive information regarding the Europeans in question."

Expedition to Spitzbergen.—Early in June Sir Martin Conway will sail either from Bergen or Tromsö, in company with Mr. A. Trevor-Battye, Mr. B. V. Darbishire, and a geologist (Dr. J. W. Gregory), for Ice Fiord, Spitzbergen. The object of the expedition is to explore the interior of the west island, which is almost wholly unknown. In 1890 Mr. G. Nordenskjöld, with two companions, landed in Horn sound and crossed the inland ice to Recherche bay in three days; and in 1892 M. Charles Rabot landed in Sassen bay, walked up the Rendal, and climbed Mount Milne-Edwards, likewise in three days. With these exceptions, no travellers have visited any part of the interior of West Spitzbergen. Sir M. Conway and his party intend to spend three months on the island.

The Arctic Ocean (Barents Sea).—At a recent meeting of the Russian Geographical Society, Lieut. Zhdanko reported on the hydrographic researches made in this part of the Arctic Ocean during the years 1893-95. One of the chief objects was to obtain more accurate maps of the magnetic elements. Declination was determined accordingly in eighty-seven different spots along the Murman (Norman) coast and in the White Sea, and, with the aid of the secular variation deduced from General Tillo's latest maps, a general map of the region was drawn. It appears that there are but few anomalies in the distribution of declination, except in the neighbourhoods of Teriberki, where it is only 1·5°, and in the Kola bay, where it attains 32° (?). The importance of a magnetic map for these regions—where the fogs often prevent astronomical determinations—will be fully appreciated by navigators. As to the measurements of temperature and

density of water, which have been made at 732 different spots, they have given the necessary materials for constructing isothermal maps of the surface temperature of water for the months of July and August for three consecutive years. It appears, from the three years' averages map, that a warm current 33 miles wide, and having a temperature of from 9° to 11° Centigrade, flows along the Murman coast. As it progresses north-east its temperature decreases, but so slowly that even on reaching Novaya Zemlya it has, at the entrance of the Matochkin Shar, a temperature of 3°. In the south-east of the Barents Sea, between the islands Kolguev and Vaigach, there is a cold zone, having a surface temperature of 0°, and even less, evidently dependent on the inflow of cold water from the Kara Sea. The breadth and extension of the warm zone vary from year to year. In 1893, which was an especially warm year, a current having a surface temperature of 5° reached the coast of Novaya Zemlya and the mouth of the Pechora; while next year (1894), which was distinguished by especially unfavourable conditions owing to the prevalence of north-east winds at the beginning of the summer, the surface temperature in July was only 3° where it had been 5° in 1893, and no temperatures of 5° were found to the east of Kolguev island, the ice covering the sea within 35 miles from the island. The ice disappeared, however, and yielded before the warm current in August. Measurements of the density of water have also been made, but not in sufficient numbers. It appears, however, that, the water of the warm branch of the Gulf Stream being characterized by a density of 1·025 and more, and by its blue colour, it would be possible to settle the limits of the warm current by means of mere density observations.

Honour to an Arctic Seaman.—Mr. John R. Radmore was gazetted to the rank of Chief Carpenter in H.M. Fleet on April 13, 1896. Mr. Radmore was one of the ten men, forming the crew of Admiral Markham's sledge, who reached the latitude of 83° 20′ 26″ N. on May 12, 1876. He fought manfully against the scurvy, and was one of the four who were able to drag the sledge alongside the ship on June 14.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Mean Atmospheric Temperature in the Southern Hemisphere.—At a recent meeting of the Austrian Meteorological Society, Professor Hann read a paper giving a comparison of the results of different and independent methods of calculating the average temperature of the air, at intervals of 10° of latitude, in the southern hemisphere. The first column of the table given below is derived from the formulæ based on the work of Zenker (*Geo. Jour.*, 1893, p. 541), the second from a treatment of actual observations by purely statistical methods, and the third from a formula developed by Hann (see his *Klimatologie*, 1883, p. 91). The close agreements of the results is very remarkable.

Latitude S.	Zenker's calculations. Fahr.	Observations. Fahr.	Hann's calculations. Fahr.
°	°	°	°
0 (Singapore)	79·0	78·8	78·8
10 (Torres Strait, British New Guinea) ...	77·5	77·7	77·9
20 (Mauritius)	72·9	73·4	73·0
30 (Natal)	65·5	65·1	64·6
40 (Bass Strait, Melbourne)	56·1	53·6	54·1
50 (Falkland Islands)	44·8	42·1	42·6
60	32·5	32·2	31·6
65 (Northern Islands of Antarctic Regions)	—	26·6	26·8
70 (North coast of Victoria Land) ...	22·6	—	22·6
80	17·2	—	16·0
South Pole	16 3	—	14·7

Only in 40° and 50° lat. do the differences exceed a few tenths of a degree. The means for 65° S. lat. in the second column are obtained from the observations of Ross and Borchgrevink. Hann is of opinion that up to 65° lat. the results he gives are substantially true mean values, and they characterize the southern as essentially the *water* hemisphere. Nearer the pole observation may yield very different results, on account of the Antarctic continent; it is to be hoped that it will soon be possible to settle this question. Hann's later work gives a mean temperature of 58·6° Fahr. for the whole southern hemisphere, slightly lower than his former value (59·7° Fahr.), and also slightly lower than the value (59·0° Fahr.) obtained for the northern hemisphere. The mean temperature for the whole of the Earth's surface is 59·0° Fahr.

GENERAL.

Monument to Captain Coquilhat.—The *Bulletin* of the Antwerp Geographical Society (1895–96, No. 3) contains the account of the inauguration in June of last year of the monument erected by the city of Antwerp in memory of Captain Coquilhat, who died at Boma in 1891. Captain Coquilhat was one of the Belgian officers who did most in the early days of the Congo State to establish its authority in the interior, and, after two separate periods of service in Africa, returned in 1890 as vice-governor of the state. His health had, however, suffered severely from the climate, and he fell a victim to dysentery in March, 1891. He had published in 1888, under the title 'Sur le Haut Congo,' an interesting work containing his notes and recollections of life in Africa. The monument consists of a bronze group, designed by the Comte de Lalaing, representing Africa, as symbolized by a negress, encircling a medallion of the young officer with palm-branches.

CORRESPONDENCE.

Makran.

In the April number of the *Journal* (p. 388), Colonel Holdich, in his paper on Makran, adopts the popular etymology of that name, viz. Mahi ("fish") and Khuran ("to eat"), on no other ground, apparently, than that the population of that coast still lives (as no doubt it has always done) on fish, and that "the derivation is too appropriate to be parted with without a struggle." Nevertheless the struggle must be endured. The word has no connection with the supposed derivation, but is a Dravidian name, which appears as Makara in the Brhat Sanhita of Varaha Mihira, in a list of the tribes contiguous to India on the west. It is also the Μακαρήνη of Stephen of Byzantium, and the Makuran of Tabari and Moses of Chorene. Even were it not a Dravidian name, in no old Aryan dialect could it signify "fish-eaters." No etymology, in fact, is so perilous as that which is merely appropriate. If Arrian had not called the people of Makran ἰχθυοφάγοι, no one would probably ever have thought of this popular but erroneous derivation.

GEORGE N. CURZON.

Theoretical Geography.

Cambridge, Mass., March 16, 1896.

In the March *Journal*, pp. 318–319, Mr. Abbe's paper is described "as a purely theoretical discussion, not based on actual observations." This does not seem to me to place the coast survey maps in their proper light. When Dr. Hann, for example, makes his studies of the observations on the Sonnblick, is his discussion a purely theoretical one? He does not make observations; fortunately, his ability is not wasted in that way; he uses actual observations, however, and in an admirable manner. I do not propose to compare Abbe, jun., and Hann, but their method of

work seems to me very similar. Each one takes the results of the careful observations of trained observers, and discusses them. Each is based on *actual* observations, if not on *personal* observations. Abbe's work does not seem to me to be purely theoretical; nor would it be redeemed from that bad class, if it had belonged there, by his visiting the capes that he described. He studied authentic records of the facts; advanced theories to account for them; considered the consequences of the theories; compared the consequences with the facts; and attempted to evaluate his results. This is not purely theoretical, but completely logical and scientific. Whether he did this scientific work well or badly, is another matter; but I regret to see it condemned as "purely theoretical, not based on actual observations." My reason for this is, in part, that I have come, from personal experience, to have a high estimate of the possibilities of scientific study of geography, through good maps, in the manner of Abbe's work. Practically, all these results * that I have published on the English and French rivers were gained at home, from maps, and only confirmed by study on the ground. The maps are as much records of facts as if they were numerical tables or verbal records. Take Leverrier's case; would his discovery of Neptune be described in the words you have applied to Abbe's work, "Not based on actual observations"?

A further reason for my regretting the condemnatory implication of your notice is that it appears to place a higher value on the ordinary phase of observation without theory, than upon what you here characterize as theory without observation. Truly, observation with theory is best; but as between going to the capes and seeing them simply with my own eyes, without using any maps, and staying at home with the advantage of the wonderfully minute and accurate maps, I should, without hesitation, choose the latter.

W. M. Davis.

OBITUARY.

The Rev. Horace Waller.

The Rev. Horace Waller, who died at East Liss on February 22, had been a Fellow of the Society for thirty-two years. On all occasions on which questions relating to those parts of Africa with which he had been more personally connected arose for discussion he was a regular attender of the meetings, always advocating the claims of the people of the country, and pressing for the development of the natural resources of our African protectorate.

Born in London in 1833, and educated under Dr. Wadham at Brook Green, Mr. Waller, after leaving school, entered into business in the city. In 1860 he went out as lay member attached to the mission sent by the Universities under Mackenzie, the first Bishop of Central Africa. Arriving off the mouth of the Zambezi in 1861, the bishop and his party were, after visiting the Comoro islands and the R · uma in company with Dr. Livingstone in H.M.S. *Pioneer*, escorted by way of the river Shire to the Nyasa highlands, where a mission was established in a district which since then has become a centre of coffee-planting. The geography and resources of that country were then little known, the district having been visited for the first time only a few years previously by Dr. Livingstone and the members of the Government Exploring Expedition. At the time of Mr. Waller's arrival, the Shire highlands were devastated by slave-hunting tribes, who sold their captives for the supply of labour at Zanzibar, Madagascar,

* Perhaps you would class these also as "purely theoretical—not based on actual observations."

and elsewhere. While then attached as lay member to the Universities Mission, more than the ordinary share of exposure and hard work fell to Mr. Waller; he travelled much in the country, and several times he passed along the rivers Shire and Zambezi, thus gaining an accurate knowledge of the people and the country. On the withdrawal of the mission from the highlands, Mr. Waller returned in 1864 to England, and, after taking Holy Orders, became eventually rector of the parish of Twywell, where he remained for twenty-two years, retiring to Hampshire only a few months before his death.

Mr. Waller's chief literary work is undoubtedly the account given by him from diaries and notes of the last journeys of Dr. Livingstone, in the preparation of which he displayed, along with marked affection for his friend, great tact and skill. He was a constant contributor on all questions connected with the slave trade, and a keen advocate of British claims to territory in East Africa; in this way he did much to bring about the British protectorate over Nyasaland, which promises to become one of the most prosperous of our African possessions.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1895-1896.

Afternoon Technical Meeting, Monday, March 16, 1896.—CLEMENTS R. MARKHAM, ESQ., C.B., F.R.S., President, in the Chair.

THE Paper read was :—

"On the Maps used by Herodotus." By John L. Myres, M.A.

Ninth Ordinary Meeting, March 23, 1896.—CLEMENTS R. MARKHAM, ESQ., C.B., F.R.S., President, in the Chair.

ELECTIONS.—*Frederick George Aflalo; F. J. Albrecht; Alexander Rowland Alston; Sir Arthur Birch, K.C.M.G.; W. Browne; Timotheus Henry Burd; John Dawson; Walter Phelps Dodge; A. Spencer Ellam; Harry Harvey; Wm. O. Stenteford; Captain Cecil Claude Walter Troughton (4th Batt. Prince of Wales' N. Staffs.); Hugh Watt.*

The PRESIDENT said: I heard this afternoon of the death of one who is well known amongst us—Lady Burton. She was the supporter and adviser of one of the greatest of our geographers, Sir Richard Burton, a household word amongst us for now nearly half a century, and during, I think, thirty years of that time Lady Burton was constantly heard of as helping and supporting him in all his work. She was a good geographer for his sake. She has lived a very retired life at Mortlake latterly, and it is now more than a year since I heard from her. She then spoke of the consolation she found in the memory of former days, and, with her usual enthusiasm, of the wonderful gifts of him she had lost. Sir Richard Burton was not always fortunate, was not always lucky, but he deserved success. He made some enemies, although he was the most agreeable man I think I ever met, and in all his good points Lady Burton followed him. He certainly was fortunate in having secured so incomparable a wife. I cannot refrain from offering this brief tribute to the memory of a distinguished woman before proceeding to the business of the evening.

The Paper read was :—

"The Waterways of English Lakeland." By John E. Marr, F.R.S.

Tenth Ordinary Meeting, April 13, 1896.—CLEMENTS R. MARKHAM, ESQ., C.B., President, in the Chair.

ELECTIONS.—*John Ainsworth; A. W. Andrews; Joseph Bradshaw, J.P.; Russell Day; Bignell George Elliott; William Griffith; T. T. Gilkison; Professor Angelo Heilprin; Syad Mohammed Lalef, Khan Bahadur; Lieut.-Colonel E. P. Maltby (Indian Army); John Linton Myres, M.A.; Major Hugh Wodehouse Pearse (East Surrey Regiment); The Lord Stanmore; John Neville Oldfield Thurston; John A. Wauchope.*

The Paper read was:—

"Popocatapetl, and the Volcanoes of the Valley of Mexico." By O. H. Howarth.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By HUGH ROBERT MILL, D.Sc., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce, Commercial.
C. R. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
J. = Journal.
M. = Mitteilungen.
Mag. = Magazine.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue, Revista.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

EUROPE.

Austria—Cherso. *Abrégé B.S. Hongroise G.* **23** (1895): 50–55. **Czink.**

Cherso. Isola nel Quarnero. Luigi Prof. Czink.

Azores.

Archivo dos Açores. Publicação periodica destinada á vulgarisação dos elementos indispensaveis para todos os ramos da Historia Açoriana. Vols. i.–xii. [Nos. 1–72.] Ponta Delgada, 1878–1894. Size 9 × 6½. *Presented by Sr. Ernesto do Canto.*

Europe in the Glacial Period. *Ymer* **15** (1895): 40–54. **Nathorst.**

Frågan om istidens växtlighet i mellersta Europa. Af A. G. Nathorst. *With Map.*

On the maximum extension of the European ice-sheet.

France—Gascogne. *B.S.G. Com. Bordeaux* **19** (1896): 98–109. **Duffart.**

Les anciennes baies de la côte de Gascogne, de la Gironde à l'Adour. Par Ch. Duffart.

Germany—Hamburg. **Melhop.**

Historische Topographie der Freien und Hansestadt Hamburg von 1880 bis 1895 (nebst vielen Nachträgen aus älterer Zeit) im Anschluss an die "Historische Topographie," von C. J. Gaedechens unter Benutzung amtlicher Quellen verfasst von W. Melhop. Hamburg: W. Manke Söhne, 1895. Size 9½ × 6½, pp. xii. and 656.

Case of 7 maps accompanying. Size 15 × 9½. *Price (Text and Maps)* 21*s.*

The maps include a complete plan of Hamburg on the scale of 1: 10,000.

Germany—People. *Globus* **69** (1896): 106–109. **Kossinna.**

Die geschichtliche Entwicklung der germanischen Volksgrenzen in Ost und West. Von Dr. Gustaf Kossinna.

An address delivered to the Philological Society of Berlin on Jacob Grimm's birthday.

Hungary—Arad. *Abrégé B.S. Hongroise G.* **23** (1895): 56–69. **Jankó.**

Land und Leute des Comitates Arad in der neueren Zeit. Dr. Johann Jankó.

A summary of the section of the great monograph on the Royal free town of Arad by Alexander Marki, dealing with its history from the time of the Turkish conquest until the present day.

Hungary—Carpathians. ———

Magyarországi Kárpátegyesület. Jahrbuch des Ungarischen Karpathen-Vereines. XXII. Jahrgang, 1895. Deutsche Ausgabe. Igló: J. Schmidt, 1895. Size 9 × 6, pp. 136 and 16. *Panorama.*

Particulars of the constitution and transactions of the Hungarian Carpathian Club, with a panorama of the Hohe Tatra from the north.

Hungary—Roads. *Abrégé B.S. Hongroise G.* **23** (1895): 37–45. **Fest.**

Le vie di comunicazione dell' Ungheria coll' Adriatico. Prof. Alfredo Fest.

On the roads from Hungary to the Adriatic.

Hungary—Transylvania. *Abrégé Hongroise B.G.S.* **23** (1895): 46–50. **Czirbusz.**

Das Jara-Thal und seine Bewohner. Prof. Dr. Géza Czirbusz.

Iceland. *G. Tidskrift* **13**, 1895–96 (1896): 99–122. **Thoroddsen.**

Fra det nordøstlige Island. Rejseberetning fra Sommeren 1895 af Dr. Phil. Th. Thoroddsen. *With Map.*

Italy—Agro-Romana. *Cosmos* (2) **12** (1895): 65–82. **d'Ossat.**

Storia fisica dell' Agro Romano, dell Dott. Gioacchino de Angelis d'Ossat. *With Section.*

A full account of the geography of a district based on its physical features, and terminating with the utilization of its natural resources.

Spitzbergen. **Hamy.**

Les Français au Spitzberg au XVII^e^ siècle. Par M. E.-T. Hamy. (Extrait du *Bulletin de géographie historique et descriptive.*) Paris: Imp. Nationale, 1895. Size 10 × 6½, pp. 28. *Maps.*

Sweden in Maps. *Ymer* **12** (1892): 81–98. **Byström.**

Sverige i utländska Kartverk. Af H. Byström.

Includes an estimate of the value of a number of atlases published in various parts of Europe, by considering the accuracy of the information shown on their maps of Sweden.

Sweden—Valleys. *Ymer* **15** (1895): 195–210. **Högbom.**

Om några genombrottsdalar i vart lands sydliga fjälltrakter. Af A. G. Högbom. *With Diagrams.*

United Kingdom—England—Mersey. **Richards.**

Report on the Present State of the Navigation of the River Mersey (1895), to the Right Honourable the Commissioners for the Conservancy of the Mersey. By Admiral Sir G. H. Richards, K.C.B., etc. With Appendix. London: Eyre and Spottiswoode, 1896. Size 10 × 6½, pp. 22. *Presented by the Mersey Commissioners.*

United Kingdom—England—Mersey. **Sweny.**

P. Literary and Philosoph. S. Liverpool **49** (1895): 87–103.

Historical Sketch of the Sea Approaches to the Mersey. By Lieutenant Mark Sweny. *With Charts.*

This will be specially noticed.

United Kingdom—Ireland. *J.S. Arts* **44** (1896): 387–391. **Haddon.**

Peasant Life and Industries in Ireland. By Prof. A. C. Haddon.

United Kingdom—Scotland—Sutherland. **Cadell.**

The Geology and Scenery of Sutherland. By Henry M. Cadell of Grange. Second Edition. Edinburgh: D. Douglas, 1896. Size 7½ × 5, pp. 108. *Maps and Illustrations.*

This will be specially noticed.

United Kingdom—Scottish Place-Names. **Don.**

Archæological Notes on Early Scotland, relating more particularly to the Stracathro District of Strathmore in Angus; also some Account of Local Antiquities and Place-Names, with Map, Plan, and Appendix. By William Gerard Don, M.D. Brechin: D. H. Edwards, 1896. Size 8 × 5½, pp. 98 and x. *Map and Plan. Presented by the Author.*

Dr. Don had occasion, in the compilation of his interesting archæological notes on the east of Scotland, to investigate many of the place-names, and the result of his researches in that direction has been to throw much light on the origin of these names, the true meaning of which had been obscured by careless copyists.

ASIA.

Central Asia. **Obrucheff.**

Verh. Russ.-K. Mineralogischen Ges. St. Petersburg (2) **33** (1895): 229–272.

Ueber die Verwitterungs- und Deflationsprocesse in Central-Asien. Von Bergingenieur W. Obrutschew. [In Russian.] *With Plates.*

Central Asia. **Younghusband.**

The Heart of a Continent: a Narrative of Travels in Manchuria, across the Gobi Desert, through the Himalayas, the Pamirs, and Chitral, 1884–1894. By Captain Frank E. Younghusband. London: John Murray, 1896. Size 9½ × 6½, pp. xviii. and 410. *Maps and Illustrations. Price* 21*s. Presented by the Publisher.*

This splendid book will be separately noticed. It gives a connected account of all the journeys in Asia which won for the author the gold medal of the R.G.S., and the reputation of being one of the most competent observers and interesting recorders who ever left this country.

Ceylon. *Deutsche Rundschau G.* **18** (1896): 145–159, 208–218, 250–260. **Radde.**

Eine Woche in Ceylon. Von Director Dr. Gustav Radde in Tiflis. *With Illustrations.*

Ceylon—Sigiriya. *J. Ceylon Branch R. Asiatic S.*, 1895, **14** (1896): 44–58. **Bell.**

Interim Report on the Operations of the Archæological Survey at Sigiriya in 1895. By H. C. P. Bell, Archæological Commissioner. *With Plans.*

The rock, on the summit of which, after destroying the vegetation, the excavations were made, had to be rendered accessible by iron ladders, and protected by railings and fences, before the work here described could be undertaken.

China—Yangtze. *B.S. Neuchateloise G.* **8** (1895): 75–79. **Mechnikoff.**

Que signifie le nom de Yangtze? Par feu Léon Metchnikoff.

Suggests that the name Yangtse-kiang = Blue river, is not due to the colour of the water, but used in contrast to the Yellow river in the sense of the superiority of the former, the antithesis being between the celestial and the terrestrial rivers.

Dutch East Indies. **Van der Chijs.**

Nederlandsch-Indisch Plakaatboek, 1602–1811. Door Mr. J. A. van der Chijs. Veertiende Deel. 1804–1808. Batavia, 1895. Size 9 × 5½, pp. 908. *Presented by the Batavian Society of Arts and Sciences.*

Dutch East Indies. **Van der Chijs.**

Dagh-Register gehouden int Casteel Batavia vant passerende daer ter plaetse als over geheel Nederlandts-India. Anno 1666-1667. Uitgegeven door het Bataviaasch Genootschap van Kunsten en Wetenschappen. Van Mr. J. A. van der Chijs. Batavia, 1895. Size 11 × 7½, pp. 430. *Presented by the Batavian Society of Arts and Sciences.*

India and the Far East—Tobacco Industry. *J.S. Arts* **44** (1896): 367–387. **Tripp.**

The Tobacco Industry of India and the Far East. By C. Tripp. *With Map and Illustrations.*

India—Census.

Census of India, 1891. Vol. XXIII. His Highness the Nizam's Dominions. Report on the Census Operations. Parts i.–iii. By Mirza Mehdy Khan (Bombay, 1893–94). *Maps and Diagrams.* Vol. XXIV. Baroda. Parts i. and ii. By Jamshedji Ardeshir Dalal (Bombay, 1894). *Map and Diagrams.* Vol. XXV. (Four parts). Mysore. By V. N. Narasimmiyengar (Bangalore, 1893–94). *Maps, Plates, and Diagrams.* Size 13½ × 8½. Supplement to the Mysore Census Report of 1891, being a List of Villages in the Mysore Province, and comparing the Populations as per Censuses of 1891, 1881, and 1871 (Bangalore, 1895). Size 14 × 8½. Vol. XXVIII. The Kashmir State. . . . By Rai Bahadur Pandit Bhag Ram (Lahore, 1893). Size 14½ × 10½. *Presented by the Secretary of State for India.*

India—Punjab.
Report on the Administration of the Punjab and its Dependencies for 1894-95. Lahore, 1896. Size 13½ × 8½, pp. xii., 220, and clxxvi. *Map and Diagram. Presented by the Secretary of State for India.*

India—Santals. *Ymer* **12** (1892): 153-186. **Heuman.**
Om Santalfolket och dess nuvarande hemland. Af Ernst Heuman.

Indian Geology. **Hudleston.**
Notes on Indian Geology, including a visit to Kashmir. By Wilfrid H. Hudleston. With an Appendix by Lieut.-General C. A. McMahon. [Reprinted from the *Proceedings* of the Geologists' Association, vol. xiv. pt. 6, February, 1896.] Size 8½ × 5½, pp. [40]. *Map and Sections. Presented by the Author.*

Japan. **Tanaka.**
IX. u. X. Jahresb. (1890 *u.* 1891) *Württemberg. Ver. Handelsg.* (1892): 132-155.
Geschichtliche Betrachtungen über den geistigen Verkehr Japans mit dem Auslande. Von Dr. Shohé Tanaka aus Japan.

Malay Archipelago—Celebes. *Globus* **69** (1896): 151-155, 171-174, 187-191. **Radde.**
Besuch auf Buton und Süd-Celebes. Von Dr. G. Radde.

Malay Archipelago—Moluccas. *Verh. Ges. Erdk. Berlin* **23** (1896): 102-143. **Warburg.**
Herr Dr. O. Warburg: Wer ist der Entdecker der Gewürz-Inseln (Molukken)?
This is reported in the *Journal* for April, vol. vii. p. 365.

Malay Archipelago—Sumatra—Bataks. **Hügel.**
The Land of the Bataks. By Baron Anatole von Hügel. From the *Geographical Journal* for January and February, 1896. Size 10 × 6½, pp. 16.

AFRICA.

Congo State—Railway. *Mouvement G.* **13** (1896): 103-114.
Le Chemin de Fer du Congo. Rapport de la Commission Belge d'Enquête. *With Map and Illustrations.*

Egypt—Goshen. *G. Tidskrift* **13**, 1895-96 (1896): 130-134. **Schmidt.**
Hvor laa det gamle Gosen? Af Professor, Dr. phil. Vald. Schmidt. *With Map.*

French West Africa—Dahomey. *Ymer* **15** (1895): 89-131. **Pomian.**
Dahome, land och folk. Af A. Hajdukiewicz de Pomian. *With Illustrations.*

Gazaland—Amakhosa Tribe. *B.S. Neuchateloise G.* **8** (1895): 126-155. **Jeanneret.**
Les Ma-Khoça. Par Philippe Jeanneret. *With Illustrations.*

German East Africa. *M. Deutschen Schutzgeb.* **9** (1896): 43-48. **Kiepert.**
Begleitworte zur Karte "Neue Aufnahmen deutscher Offiziere in Ussagara, Ugogo, Uhehe und Mahenge." Von Dr. R. Kiepert.

German East Africa. *M. Deutschen Schutzgeb.* **9** (1896): 3-32.
Die Ergebnisse der meteorologischen Beobachtungen an der wissenschaftlichen Kilimandjarostation Marangu. *With Illustration.*

German West Africa—Togoland. **Kling.**
IX. u. X. Jahresb. (1890 *u.* 1891) *Württemberg. Ver. Handelsg.* (1892): 89-112.
Meine Reisen im Togolande. Von Hauptmann Kling.

German West Africa—Cameroons. *Ymer* **12** (1892): 113-152. **Waldau.**
Resa till Ngolo-landet. Af Georg Waldau.
Resa från Ndian faktori genom Ngolo, norra Bakundu och öfver Rumbiberget till Bonge faktori. Af Georg Waldau. *With Map.*

Liberia. **Cook.**
[Liberia.]—Third Report to the Board of Managers of the New York State Colonization Society. By O. T. Cook. New York: J. Bingham, 1896. Size 9½ × 6, pp. 100. *Illustrations.*

Natal. *J.R. Colonial I.* **27** (1896): 272-306. **Maydon.**
Natal. By J. G. Maydon.

Portuguese East Africa—Lorenzo Marques. **Berthoud.**
B.S. Neuchateloise G. **8** (1895): 100-111.
Lourenço Marques. Conférence donnée à Neuchâtel le 5 février 1895, 10me anniversaire de la fondation de la Société Neuchâteloise de Géographie. Par Paul Berthoud, missionnaire à Lourenço Marques. *With Illustrations.*

Portuguese East Africa—Tembé. *B.S. Neuchateloise G.* **8** (1895): 112–125. **Junod.**
Une course au Tembé. Par Henri Junod.

South Africa—Argus Annual. ——
The Argus Annual and South African Gazetteer, 1896. Johannesburg, etc.: the Argus Printing and Publishing Co., Limited. Size 8½ × 5½, pp. 606. *Presented by the Publishers.*

Transvaal—Bokaha country. *B.S. Neuchateloise G.* **8** (1895): 156–174. **Thomas.**
Le Bokaha, quelques notes sur le pays, ses habitants et ses ressources. Par E. Thomas.

Tripoli. **Cowper.**
Notes of a Journey in Tarhuna and Gharian, Tripoli. By H. S. Cowper. From the *Geographical Journal* for February, 1896. Size 10 × 6½, pp. [16]. *Map and Illustrations.*

West Africa. *Scottish G. Mag.* **12** (1896): 113–124. **Kingsley.**
Travels on the Western Coast of Equatorial Africa. By Miss M. W. Kingsley.

West Africa—Basin of the Gambia. **Rançon.**
Étude de Botanique exotique. La Flore utile du Bassin de la Gambie. Par le Dr. André Rançon. Extrait du *Bulletin de la Société de géographie commerciale de Bordeaux.* Bordeaux: Imp. G. Gounouilhon, 1895. Size 10 × 6½, pp. 160. *Map. Presented by the Author.*

This work has been noticed from time to time as it appeared in the *Bulletin* of the Bordeaux Geographical Society.

West Africa—Gold Coast. **Reindorf.**
History of the Gold Coast and Asante, based on traditions and historical facts, comprising a Period of more than Three Centuries, from about 1500 to 1860. By Rev. Carl Christian Reindorf. Basel, the Missionsbuchhandlung, 1895. Size 9 × 6, pp. xvi. and 356. *Illustrations.*

NORTH AMERICA.

Canada. **Harris.**
A Lecture delivered at the Imperial Institute, on the 17th February, 1896, by Colonel J. Harris, on the New British Route to the Pacific. London: Printed by Spottiswoode & Co., 1896. Size 8½ × 5½, pp. 24. *Presented by the Author.*

Canada—British Columbia. ——
Annual Report of the Minister of Mines for the Year ending 31st December, 1894, being an account of Mining Operations for Gold, Coal, etc., in the Province of British Columbia. Victoria, B.C., 1895. Size 10½ × 7½, pp. [56].

Canada—Hudson Bay. *American J. Science* (4) **1** (1896): 219–228. **Bell.**
Proofs of the Rising of the Land around Hudson Bay. By Robert Bell.

Canada—Vancouver Island—Alberni District. **Sutton.**
Report on the Mining Section in Alberni District, V.I. By William J. Sutton. Victoria, B.C., 1895. Size 11 × 7½, pp. 8. *Sketch-map.*

United States. *National G. Mag.* **7** (1896): 116–122. **Blodgett.**
"Free Burghs" in the United States. By James H. Blodgett.

United States—Eleventh Census. ——
Department of the Interior, Census Office. Robert P. Porter, Superintendent. Compendium of the Eleventh Census, 1890. Part i.—Population. Part ii.—Miscellaneous Statistics. Washington: Government Printing Office, 1892–94. Size 12 × 8½, pp. (Part i.) cxl. and 958; (Part ii.) 1064. *Charts.*

Eleventh Census of the United States, 1890. Mineral Industries (1892, pp. xvi. and 858, maps and plates); Wealth, Debt, and Taxation. Part i.—Public Debt (1892, pp. iv. and 890, map and diagrams); Population and Resources of Alaska (1893, pp. xii. and 282, map, coloured plates, etc.); Vital Statistics, District of Columbia and Baltimore (1893, pp. 242, maps); Education Institutions (1893, pp. 142); Transportation on the Pacific Coast, exclusive of Alaska (1893, pp. 102, map); Manufacturing Industries. Electrical Industries in the State of New York, by Allen R. Foote (1894, pp. [36]); ditto, Textiles (1894, pp. iv. and 236); Vital Statistics, New York and Brooklyn (1894, pp. iv. and 530, maps); Irrigation (1894, pp. viii. and 284, maps and plates); Churches (1894, pp. xxviii. and 812, maps and diagrams); Insurance, Part i. (1894, pp. x. and 1128); Indians (1894, pp. vi. and

684, maps, coloured plates, etc.); Transportation Business. Part ii.—Transportation by Water (1894, pp. xiv. and 532, map); Vital and Social Statistics. Part iii.—Statistics of Deaths (1894, pp. iv. and 1052); Vital Statistics, Boston and Philadelphia (1895, pp. iv. and 270, maps); Population. Part I. (1895, pp. ccxiv. and 968, maps and diagrams); Manufacturing Industries. Part iii.—Selected Industries (1895, pp. vi. and 726); Social Statistics of Cities (1895, pp. iv. and 138, Diagrams); Crime, Pauperism, and Benevolence. Part ii.—General Tables (1895, pp. x. and 1036, tables). Washington: Government Printing Office. Size 12 × 9½. *Presented by the Government of the United States.*

United States—Indian Territory. *National G. Mag.* 7 (1896): 112–115. **Gannett.**
Survey and Subdivision of Indian Territory. By Henry Gannett. *With Map and Illustrations.*

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Is the Monroe Doctrine involved in the controversy between Venezuela and Great Britain? By Chas. P. Daly, LL.D. (Reprinted from the *N. Y. Herald* of January 19 and February 2, 1896.) Size 9½ × 6½, pp. 18. *Presented by the Author.*

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Im Delta des Orinoko. Von Eberhard Graf zu Erbach-Erbach.

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The West Indies and the Spanish Main. By James Rodway. (The Story of the Nations Series.) London: T. Fisher Unwin, 1896. Size 8 × 5¼, pp. xxiv. and 372. *Map and Illustrations. Price* 5*s. Presented by the Publisher.*

The history of the occupation of the West Indies by the Spaniards, the search for El Dorado, the days of the Buccaneers, the problem of negro slavery told in several graphic chapters, and the revolutions and settlements which have brought about the present state of affairs in the islands.

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The Paradise of the Pacific. Sketches of Hawaiian Scenery and Life. By the Rev. H. H. Gowen. London: Skeffington & Son, 1892. Size 8 × 5¼, pp. 180. *Frontispiece. Presented by the Author.*

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Statistics of the Colony of New Zealand for the year 1894: with Abstracts from the Agricultural Statistics of February, 1895, and Statistics of Local Governing Bodies for the year ended March 31, 1895. Wellington, 1895. Size 13½ × 8½, pp. xii. and 470. *Presented by the Colonial Government of New Zealand.*

New Zealand—Minute Fauna. *Globus* **69** (1896): 149–151, 174–177. **Kraemer.**

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Arctic Discoveries. **Greely**

Handbook of Arctic Discoveries. By A. W. Greely. (Columbian Knowledge Series, edited by Professor Todd. *No. III.*) London: Low & Co., 1896. Size 7½ × 4½, pp. x. and 258. *Portrait and Charts. Price* 5*s. Presented by the Publishers.*

A clear and remarkably concise record of Arctic discoveries provided with a useful bibliography.

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The so-called "Jeannette Relics." By Professor William H. Dall.

Bringing forward the evidence which leads the author to suppose that the relics

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Om väderteksförhallandena i norra polarområdet under sommaren, särskildt med afseende på den tilltänkta polarfärden i luftballong. Af Nils Ekholm. *With Maps.*

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Förslag till polarfärd med luftballong. Af S. A. Andrée.

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Några skildringar från den Wellmanska polarexpedition en 1894. Af H. Wästfält.

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Geodetic Surveys.

Report of the Superintendent of the U.S. Coast and Geodetic Survey for the Fiscal Year ending June 30, 1893, in Two Parts. Part ii. Appendices relating to the Methods, Discussions, and Results of the Coast and Geodetic Survey. Washington: Government Printing Office, 1895. Size 9½ × 6, pp. 640. *Maps and Illustrations. Presented by the U.S. Coast and Geodetic Survey.*

This volume contains a very full report on photographic surveying, and many papers on other questions connected with exact surveys.

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The Application of Photography to Topographic Surveying. By George Heimbrod.—The *New Zealand Surveyor*, December, 1895. Dunedin: Stone, Son & Co. Size 10 × 6½, pp. 70–81. *Presented by the Author.*

The Cornoide. **Sanchez.**

Alberto Sanchez. La Cornoide. 1895. San Salvador, Imp. Nacional. Size 8½ × 6, pp. 72. *Plate.*

Discussion of the properties of a curve applicable to map-projections.

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On the Best Method of Teaching Military Sketching. By Captain A. H. C. Kenney-Herbert.

A thoroughly practical exposition of the method of teaching map-reading and topographical sketching in the Military College.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Earth-Movements. **Milne.**

Movements of the Earth's Crust (Bradyseisms, Earthquakes, Diurnal Waves, Tremors). By John Milne. From the *Geographical Journal* for March, 1896. Size 10 × 6½, pp. 28. *Illustrations.*

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Open-Air Studies: an Introduction to Geology Out-of-Doors. By Grenville A. J. Cole. London: C. Griffin & Co., 1895. Size 8 × 5½, pp. xii. and 322. *Illustrations.*

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Glacial Formations. *B. S. Neuchateloise G.* 8 (1895): 239–255. **Du Pasquier.**

Glaciers et période glaciaire. . . . Par Léon du Pasquier.

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Professor Bonney has endeavoured, in this book, to lay stress on the fundamental facts on which all hypotheses as to the action of ice on land-surfaces must be built.

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Phénomènes physiques des hautes régions de l'atmosphère. Par A. Cornu. *With Illustrations.*
Report of a lecture at the Royal Institution, with illustrations of the experiments shown on the artificial imitation of the phenomena of cyclones, waterspouts, and other air-movements.

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The Guinea and Equatorial Currents. (A Review.) By J. Y. Buchanan. From the *Geographical Journal* for March, 1896. Size 9¼ × 6¼, pp. 4.

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Der normale Erdmagnetismus. Von Wilhelm von Bezold.

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Anthropogeography. *Globus* **69** (1896): 85–88, 109–113. **Bebber.**
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Treats mainly of climate and health.

Columbus and Toscanelli. *Ymer* **12** (1892): 187–197. **Carlson.**
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Hellenische Kolonisation. Von Professoratsverweser G. Lachenmaier.

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A critical review of the life and works of the great Scandinavian geographer, Olaus Magnus.

Means of Communication. **Metzger.**
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Zur Technik der Ausbeutung berufsstatistischer Angaben. Von Dr. Georg von Mayr. Sonderabzug aus Allgemeines Statistisches Archiv. IV. i. 1896. Herausgegeben von Dr. Georg von Mayr. Tübingen: H. Laupp. Size 9½ × 6½, pp. [20]. *Presented by the Author.*

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Württembergische Forschungsreisende und Geographen des 19. Jahrhunderts. Festschrift zur Feier des 25 jährigen Regierungsjubiläums Sr. Majestät des Königs Karl. Im Auftrage des Württ. Vereins für Handelsgeographie bearbeitet von Emil Metzger.

Includes biographical and bibliographical notices of the natives of Württemberg who have taken part in geographical work.

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This biography, which contains much new matter, will be specially noticed.

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Leuzinger. *Deutsche Rundschau G.* **18** (1896): 279-282. ——

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Claudius Ptolemy and his Works. By W. T. Lynn.

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Anti-Slavery in Art. **Hamy.**

M. E.-T. Hamy. Les imitateurs d'Alexander Brunias, John Milton, Pierre Fréret, M.-L.-A. Boizot (1788–1794) (Extrait de *l'Anthropologie*, No. 1, 1895). Paris: G. Masson. Size 10 × 6½, pp. 12.

M. Hamy describes the share taken in the emancipation movement of a hundred years ago by a number of artists, English and French.

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Arabia and Abyssinia in Ancient Times. By J. W. M'Crindle.

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Catalogue Général de la Librairie Française continuation de l'ouvrage d'Otto Lorenz (Période de 1840 à 1885, 11 volumes). Tome Treizième (Table des Matières du Tome XII., 1886–1890) Rédigé par D. Jordell. Premier Fascicule: A—L. Paris: Librairie Nilsson, 1895. Size 10 × 6½, pp. 240.

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An Authors' Catalogue with detailed subject-index.

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This is a combined Authors and Subjects Catalogue in one alphabet, with numerous cross-references.

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A classified catalogue dealing with works on various departments of science.

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Catalogue of Scientific Papers (1874-1883) compiled by the Royal Society of London. Vol. xi. London: C. J. Clay & Sons, 1896. Size 11½ × 9, pp. 902. *Presented by the Royal Society.*

This invaluable authors' index is now complete to the end of 1883; and it is to be hoped that the next decade, already in the past, may be somewhat more promptly prepared for publication.

British Empire. *Blackwood's Mag.* (1896): 364–381. ——

The Growth of the British Empire.

Commercial Geography. *J. Franklin I.* **141** (1896): 81–97, 171–182. **Haupt.**

Commerce and Deep-waterways. By Prof. Lewis M. Haupt. *With Illustrations.*

As an instance of the advantages of waterways, it is noted that a steamer in one trip towed barges containing over 8500 tons of coal down the Mississippi, an amount which would require a train of 285 goods cars, *i.e.* a train more than two miles long, to be transported by railway.

Commercial Geography. ——

Special Consular Reports. Highways of Commerce. The Ocean Lines, Railways, Canals, and other Trade Routes of Foreign Countries. Vol. xii. Issued from the Bureau of Statistics, Department of State. Washington: Government Printing Office, 1895. Size 9 × 6, pp. 764. *Maps.*

A work of considerable value geographically, describing in some detail, with maps, the ocean routes of the world, and the railway and telegraph systems of all countries outside the United States.

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Contains an account of the history and cultivation of the cocoa tree, a history of the uses of cocoa, descriptions of its manufacture, etc.

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Commercial Geography—Navigation. **Blackmore and Colomb.**

[Course of Papers (No. 40).] Shipmasters' Society, London. Seventh Session. Introductory Address, by Captain E. Blackmore. The Manœuvring Powers of Steamships and the Avoidance of Collisions. By Vice-Admiral P. H. Colomb. London: Pewtress & Co., 1895. Size 8½ × 5½, pp. 56. *Diagrams.*

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A Complete Collection of the Treaties and Conventions and Reciprocal Regulations at present subsisting between Great Britain and Foreign Powers: and of the Laws, Decrees, Orders in Council, etc., concerning the same; so far as they relate to Commerce and Navigation, the Slave Trade, Post-office Communications, Copyright, etc. Compiled . . . and edited by Sir Edward Hertslet, K.C.B. Vol. xix. London: Butterworth & Co., 1895. Size 9 × 6, pp. xxxii. and 1104.

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Complete Geography. By Alex. Everett Frye. With Supplement, The New England States, by William Morris Davis. Pp. 32. Boston, U.S.A., and London: Ginn & Co., 1895. Size 12½ × 10½, pp. viii. and 184. *Maps and Illustrations. Presented by the Publishers.*

This is the most recent and perhaps the most ably illustrated of the text-atlas form of school-geography which finds favour in the United States. The pictures are extremely characteristic; those of the physical features of New England are by far the best text-book illustrations we have seen. The standpoint of the work is that of the United States citizen; the countries of the Old World are, however, inadequately handled. The maps are well designed or carefully copied, but the colour-printing is bad.

Educational.

Longmans' Geographical Series. Book i. The Child's First Book of Geography. With 17 Illustrations and 52 Maps. London: Longmans, Green & Co., 1896. Size 7½ × 5, pp. viii. and 166. *Maps and Illustrations. Price* 1*s.* 6*d. Presented by the Publishers.*

This series of geographies—the first of which is anonymous—is intended to deal in successively fuller detail with the same range of facts. The first book is simply written and well illustrated, containing a number of excellent coloured maps, showing only general features, but showing them very clearly.

Educational.

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The lantern slides named in this catalogue are sets which have been specially prepared for use in schools by members of the Association, amongst whom they are circulated.

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Geography as a School-subject. An attempt to show that Geography can be taught as a training of the mind. By B. Bentham Dickinson. Printed by request of the Geographical Association. Rugby: Printed by A. J. Lawrence, 1896. Size 8½ × 5½, pp. 32. *Presented by the Author.*

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Town Plans—10-feet scale:—

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London—Re-survey, VII. 16, 34, 35, 44, 45, 46, 57, 64, 67, 75, 76, 78; VIII. 95, 96, 97; XI. 95; XII. 5, 7, 8, 16, 18, 25, 26, 27, 36, 37, 2*s*. 6*d*. each.

MISCELLANEOUS:—**Index** to the East Riding of Yorkshire, coloured in parishes, showing 6-inch sheets only, price 6*d*. **Indexes** to Anglesey, Rutland, and Warwick, coloured in parishes, showing 25-inch sheets only, price 6*d*. each.

(*E. Stanford, Agent.*)

Russia—Caucasus. **Kondratenko.**

Ethnographical Maps of Governments and Provinces of the Trans-Caucasus. Compiled by the Director of the Imperial Geographical Society. E. Kondratenko. Appendix to vol. xviii. Zapiski Caucasus Section, Russian Geographical Society.

ASIA.

Indian Government Surveys. **H.M. Secretary of State for India, through Indian Office.**

Indian Atlas, 4 miles to an inch. Sheets: No. 7, parts of Deri Ghazi Khan, Rajanpur, etc., additions to 1885; No. 48, districts Puttiala Umballa, Thanesur, Kurnal, and parts of Sirmur Hurriana, Paniput (Punjab), district Dehra, and parts of districts Suharunpur, Bijnur, and Mazufurnugur (N.W. Provinces), with additions to 1893; No. 7*b*, parts of districts Tanjore, Trichinopoly, Salem Coimbatore, Madura, and

South Arcot (Madras Presidency), Pondicherry, and Karikal (French territory) additions to 1894; No. 108, part of Vizagapatam, additions to 1894; No. 109, part of Vizagapatam, additions to 1895. Quarter-sheets: No. 60 N.E., parts of districts Bangalore, Kolar, and Tumkur (Mysore), 1895; No. 67 S.E., parts of districts Bareilly, Pilibhit, and Shahjahanpur (N.W. Provinces), and Kheri (Oudh), additions to 1895; No. 69 S.E., parts of Panna, Ajaigarh, Charkhari, and Chhatarpur (Native States Bundelkhand Agency), and of districts Hamirpur, Futtehpur, and Banda (N.W. Provinces), additions to 1892; No. 105 N.E., parts of districts Palamau, Lohardaga, and Singhbhum, and of Jashpur State (Chota Nagpur), Bengal, additions to 1895.—Bengal Survey, 1 mile to an inch. Sheets: No. 269 (preliminary edition), district Darjeeling, Seasons 1861–67 and 1881–83; Nos. 293, 294, 295, 315, 316, 317, 337, 338, 339, district Jalpaiguri (Western Duars), Seasons 1888–92.—Bombay Survey, 1 inch to a mile. No. 167 (special edition showing forests), districts Poona, Kolaba, and Satara, and Habsan and Bhor States, Seasons 1884–85; No. 176, part of district Ratnagiri, Season 1893–94.—Central India and Rajputana Survey, 1 inch to a mile. No. 431, parts of districts Damoh and Jubbulpore (Central Provinces), and of Panna Native State (Central India Agency), Seasons 1856–57, 1864–66, and 1869–70; No. 450, Parts of districts Jubbulpore and Mandla (Central Provinces), and Native State of Rewah (Central India Agency), Seasons 1860–62, 1868–69, 1873–74.—North-Western Trans-Frontier, 4 miles to an inch. No. 28 S.E., parts of districts Bannu Dera Ismail Khan, Kohat Shahpur, Jhelum (Punjab), and Mahsud Waziris, additions to 1893.—Aden Survey, 2 miles to an inch. No. 1 (2nd edit.), No. 2 (2nd edit.), No. 4 (2nd edit.), No. 5, parts of Arabia, Seasons 1891–94.—Skeleton Map of the Punjab and surrounding countries, 1874, 1 inch to 32 miles; additions to 1895.—The Provinces of Bengal, Bihar, Orissa, and Chota Nagpur, under the jurisdiction of the Lieut.-Governor of Bengal, with the Province of Assam under the Chief Commissioner, 64 miles to an inch, August, 1895.—District Rangpur, Lower Provinces Bengal, 4 miles to an inch; additions to 1894.—District Howrah, Bengal, 4 miles to an inch; additions to 1895.—Bengal, 80 miles to an inch, July, 1888.—District Amritsar, Punjab, 8 miles to an inch, 1895.—District Angul, Bengal, 8 miles to an inch, 1895.—District Damoh (Central Provinces), 8 miles to an inch, 1895.—District Manbhum, Bengal, 8 miles to an inch, 1890.—Index to the Standard Sheets of Central India and Rajputana.—Bengal, Bihar, Orissa, and Chota Nagpur, 16 miles to an inch, 1895; 2 sheets.—Chart of Triangulation, Madras Forest Survey, Tinnevelly district, 2 sheets and Table, 2 miles to an inch, Seasons 1886–92.—*Presented by H.M. Secretary of State for India, through India Office.*

AFRICA.

Abyssinia. **Istituto Cartografico Italiano.**

Schizzo del Teatro della Guerra Italo-Abissina. Scale 1: 333,000 or 5·2 stat. miles to an inch. Compilato dal Tenente Guglielmi. Edito dall' Istituto Cartografico Italiano. Roma, 1896. *Presented by the Istituto Cartografico Italiano.*

This map illustrates the scene of recent operations of the Italian forces in Abyssinia, and includes the country between Asmara in the north and Antalo in the south, and between the coast at Arafali on the east, and Tambuk, to the west of Aksum, on the west. An attempt has been made to indicate the relief of the country by shading, which cannot be considered altogether satisfactory, and the shading in some cases is not consistent with the difference of altitude as indicated by figures. It will, however, doubtless be a useful map of reference at the present time.

N.E. Africa. **Johnston.**

W. and A. K. Johnston's Map of Nubia and Abyssinia to illustrate Dongola Expedition, 1896. Scale 1: 2,854,868 or 45·7 stat. miles to an inch. W. and A. K. Johnston, Edinburgh and London, 1896. *Presented by the Publishers.*

AUSTRALIA.

Western Australia. **Bewick, Moreing and Co.**

Map of the Western Australian Goldfields (Southern Portion). Drawn and compiled by Messrs. Bewick, Moreing & Co., mining engineers, from special surveys made by them, and from the latest information from the Mining Department of Western Australia. Scale 3·6 stat. miles to an inch. 12 sheets. *Presented by C. Algernon Moreing, Esq.*

This map includes the country between lat. 28° 15′ S. and the southern coast, and from long. 118° 25′ E. to 122° 40′ E., and thus includes the district of special interest at the present time in connection with the gold-mining developments. It

contains a great deal of information respecting the water-supply, gold leases, town sites, routes, etc., that cannot fail to be of service to those who have special interests in the district, and gives as insets a general key map of Western Australia, and a diagram showing the annual export of gold from that colony since 1887. The map is somewhat roughly lithographed, but is on a large scale, and the information it contains is clearly expressed by different colours and symbols.

Western Australia. **Calvert.**

Albert F. Calvert's Map of Western Australia, showing the goldfields. Supplement to the *West Australian Review*. Scale 1 : 6,000,000 or 94·3 stat. miles to an inch. —Albert F. Calvert's Geological Sketch Map of Coolgardie. Supplement to the *West Australian Review*. Scale 17·7 stat. miles to an inch. The Edinburgh Geographical Institute. *Presented by A. F. Calvert, Esq.*

GENERAL.

German Colonies. **Deutsche Kolonialgesellschaft.**

Kleiner Deutscher Kolonialatlas. Herausgegeben von der Deutschen Kolonialgesellschaft. Geographische Verlagshandlung Dietrich Reimer (Ernst Vohsen). Berlin, 1896. *Preis* 50 *pf.*

Maps of the German colonies throughout the World are given in this atlas. The first is a general map of the World, showing the position of the various colonies with the tracks followed by the German steamship lines. This is followed by a map of Europe and Africa, upon which the German possessions are shown. Then come (Nos. 3 and 6) maps of the German possessions in Africa, on the scale of 1 : 5,000,000, and the last is a map of the Western Pacific Ocean, showing the islands claimed by Germany.

There is explanatory letterpress to accompany each of the maps, and, taken altogether, the publishers may be congratulated on having brought out a very cheap and useful little atlas, though necessarily the maps are not produced in the most finished style.

Historical Geography. **Schrader.**

Atlas de Géographie Historique Par une Réunion de Professeurs et de Savants sous la Direction Géographique de F. Schrader, contenant en 55 feuilles doubles, 167 cartes en couleurs accompagnées d'un texte historique au dos de 115 Cartes figures et plans en noir, dans le texte, et d'un index alphabétique des noms contenus dans l'atlas. Paris : Librairie Hachette et Cie., 1896.

This important and useful atlas is now complete. The maps, which have been noticed in this *Journal* from time to time as they have appeared, are carefully executed, and the explanatory letterpress contains a vast amount of historical information that must prove of great value to the student, and interesting to the general reader.

The World. **Herrich.**

Wandkarte des Weltverkehrs (Ausgabe für Oesterreich-Ungarn) Aquatorial, Massstab 1 : 22,000,000 or 5° to an inch. Mit 4 Nebenkarten Central Amerika, Massstab 1 : 11,000,000. Nordsee und Kanal, Strasse von Suez und Strasse von Malakka, Massstab 1 : 4,400,000. Bearbeitet von A. Herrich. Glogau : Druck und Verlag von Carl Flemming, 1896. 4 sheets. *Price unmounted,* 12 *marks.*

This is a new edition of a commercial map of the World published last year.

The World. **Spamer.**

Spamer's Grosser Hand-Atlas in 150 Kartenseiten nebst alphabetischem Orts-Register und 150 Folio-Seiten Text enthaltend eine geographisch-statistische und ethnographische Beschreibung aller Teile der Erde, bearbeitet von Dr. Alfred Hettner, a. o. Prof. an der Universität Leipzig. Mit ca 600 Karten, Plänen und Diagrammen. Verlag von Otto Spamer. Leipzig, 1896. Parts 1 and 2. *Preis* 50 *pfg. each part.*

There are at the present time so many atlases to be obtained at a moderate price, that the publisher of this might well have hesitated before bringing out another. However, this promises to be a useful work, and is certainly surprisingly cheap. As to its arrangement, it appears to be very similar to Schrader's 'Atlas de Géographie Moderne,' published by Messrs. Hachette & Cie, Paris, and some of the maps in these parts appear to be identical with those contained in that atlas, except that the names have been transliterated. Like the latter, each map is accompanied by explanatory letterpress with insets, which add considerably to its value.

Parts I. and II. contain the following maps : Part I., Südwestdeutschland ; Böhmen, Mähren, Schlesien, Ober- und Niederösterreich ; Das westliche Russland und Rumänien. Part II., Nordwestdeutschland ; Ungarn und Galizien ; Die Mittelmeerländer. Some of these are fairly well executed, but others, especially that of Bohemia, etc., are so overcrowded with names, that the physical features are, to a great extent, obliterated.

It is the intention of the publisher to complete the atlas in thirty-two parts, one of which is to appear every week or fortnight, as may be found practicable.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during January and February, 1896. *Presented by the Hydrographic Department, Admiralty.*

No	Inches.	
2935		Oceanic soundings, Sheet 3:—Eastern Pacific ocean. 1*s.* 6*d.*
2936		Oceanic soundings, Sheet 1:—Atlantic ocean. 1*s.* 6*d.*
2937		Oceanic soundings, Sheet 2:—Indian and Western Pacific oceans. 1*s.* 6*d.*
871	m = 14·0	England, south coast:—Tamar river. 2*s.*
1404	m = 12·0	Scotland, west coast:—Ardrossan harbour. 1*s.* 6*d.*
1039	m = 6·1	Norway, south coast:—Christiania harbour. 1*s.* 6*d.*
73	m = 12·0	Spain, north coast:—Port Pasages. 1*s.* 6*d.*
80	m = 5·4	Spain, west coast:—Port of Ferrol. 2*s.* 6*d.*
2629	m = 3·9	Malta island:—Part of the south coast with Filfola island. 1*s.* 6*d.*
2628	m = 3·9	Malta island:—South-east portion. 2*s.* 6*d.*
381	m = 4·0	Archipelago:—Mityleni anchorage and adjacent coast. 1*s.* 6*d.*
2489	m = 0·9	North America, east coast:—Nantucket sound and eastern approaches. 2*s.* 6*d.*
1216	m = 1·5	Africa, west coast:—Great Fish bay. 2*s.* 6*d.*
629	m = 0·29	Africa, west coast:—Walfisch bay. 2*s.* 6*d.*
2735	m = 0·7	China:—Si Kiang or West river, Sheet 3; Chau sun to Wu Chu fu (reproduction). 2*s.* 6*d.*
2734	m = 0·7	China:—Si Kiang or West river, Sheet 2; Sam chau to Chau sun (reproduction). 2*s.* 6*d.*
2641	m = 3·7	South Pacific ocean:—Guasopa harbour. 1*s.* 6*d.*
2392	m = 0·5	Solomon islands:—Vella Lavella to Wana Wana. 2*s.* 6*d.*
2659	m = var.	Anchorages in the Solomon islands:—Jack harbour, Rice anchorage, Kolieuro inlet. 1*s.* 6*d.*
2658	m = 6·0	Solomon islands:—Gavutu harbour. 1*s.* 6*d.*
2383	m = var.	Anchorages in the Solomon islands:—Márovo lagoon, Mongo entrance, Charapoana entrance, Tongoro entrance, 1*s.* 6*d.*
379	m = 0·5	Fiji islands:—Vatu Ora channel, with adjacent coasts. 2*s.* 6*d.*
2391	m = var.	Ports in the Philippine islands:—New plans, Port San Miguel, Port Barrera.

J. D. Potter, agent.

Charts Cancelled.

No.		Cancelled by	No.
1404	Ardrossan harbour.	New Chart. Ardrossan harbour	1404
1039	Christiania harbour.	New Chart. Christiania harbour	1039
73	Port Pasages.	New Chart. Port Pasages	73
80	Ferrol harbour.	New Chart. Port of Ferrol	80
2249	Malta from Valletta to Marsa Scirocco.	New Charts. Malta, south-east portion	2628
		Malta, part of the south coast	2629
1665	Plan of Mityleni harbour on this chart.	New Chart. Mityleni anchorage and adjacent coast	381
2489	Monomoy or Old Stage harbour.	New Chart. Nantucket sound and eastern approaches	2489
617	Sherbro' river.	Large corrections to Isles do Los to Sherbro' island	601
629	Walfisch bay settlement, Walfisch bay.	New Chart. Walfisch bay	629
1806	Plan of Great Fish bay on this chart.	New Chart. Great Fish bay	1216

2734 Si-kiang or West river, Kau Kong to Chau-sun.	New Chart. Si-kiang or West river, Sam chau to Chau-sun 2734
2735 Si-kiang or West river, Kau Chau-sun to Wu-chau-fu.	New Chart. Si-kiang or West river, Chau-sun to Wu chu fu. 2735
2641 Guasap harbour (Woodlark island).	New Chart. Guasopa harbour 2641
1414 Plan of Gavutu anchorage on this coast.	New Chart. Gavutu harbour 2658
2383 Márovo lagoon.	New Chart. Anchorages in the Solomon islands . 2383
2889 Atchafalaya bay.	

Charts that have received Important Corrections.

No. A to P Index charts, 16 sheets. 1167, England and Wales, west coast:—Burry inlet. 1491, England, east coast:—Harwich harbour. 2397B, Scotland, north and east coasts. 2739, Ireland, west coast:—Tralee and Brandon bays. 1872, Netherlands:—Calais to the river Scheldt entrance. 2300, Gulf of Bothnia, Sheet 5:—Stiernö point, Fiaderäg, and Stor fiörd to Gamla Karleby. 2224, Gulf of Finland:—Helsingfors, Sveaborg, and parts adjacent. 89, Portugal:—Entrance to the river Tagus, etc. 1483, Adriatic sea:—Ports Chioggia, Malamocco, and Lido, and the channels leading to Venice. 1659, Archipelago:—Lemnos island. 2234, Sea of Azov. 2490, east coast of America:—Pemaquid point to Fletcher's neck. 2482, east coast of America:—Fletcher's neck to Cape Cod. 2580, Cuba, eastern portion. 456, Jamaica:—Port Royal and Kingston harbours. 601, Africa, west coast:—Isles do Los to Sherbro' island. 1862, Africa, west coast, Sheet 17:—Lekki to river Dodo. 2776A, Africa, west coast:—River Niger, Sheet 1. 1369, Africa, west coast:—Brass river and creeks. 1920, Africa, south coast:—Table bay. 644, Africa, east coast:—Delagoa bay (Lorenzo Marques). 646, Africa, east coast:—English river, bar, and harbour. 645, Africa, east coast:—Port Melville. 648, Africa, east coast:—Delagoa bay to river Zambezi. 2089, Africa, east coast:—Tugela river to Delagoa bay. 238, Africa, east coast:—Kilifi river and approaches. 898, Bay of Bengal:—Port Mouat, Port Campbell. 947, Borneo island;—Victoria harbour. 967, Paláwan island. 1764, China, east coast:—Amoy inner harbour. 2601, Solomon islands:—Wana Wana to Mbulo island. 2421, Pacific ocean:—Tonga or Friendly islands. 1176, Islands in South Pacific.

J. D. Potter, Agent.

PHOTOGRAPHS.

New Zealand. **Fitz Gerald.**

Sixty-six Photographs of the Southern Alps of New Zealand, taken by E. A. Fitz Gerald, Esq. *Presented by E. A. Fitz Gerald, Esq.*

The geological structure, glacial phenomena, etc., of the Southern Alps of New Zealand are clearly illustrated by these excellent photographs. Mr. Fitz Gerald may be congratulated on his results, especially when it is remembered that in many cases they must necessarily have been taken under trying circumstances.

Spitzbergen. **Corbett and Drummond.**

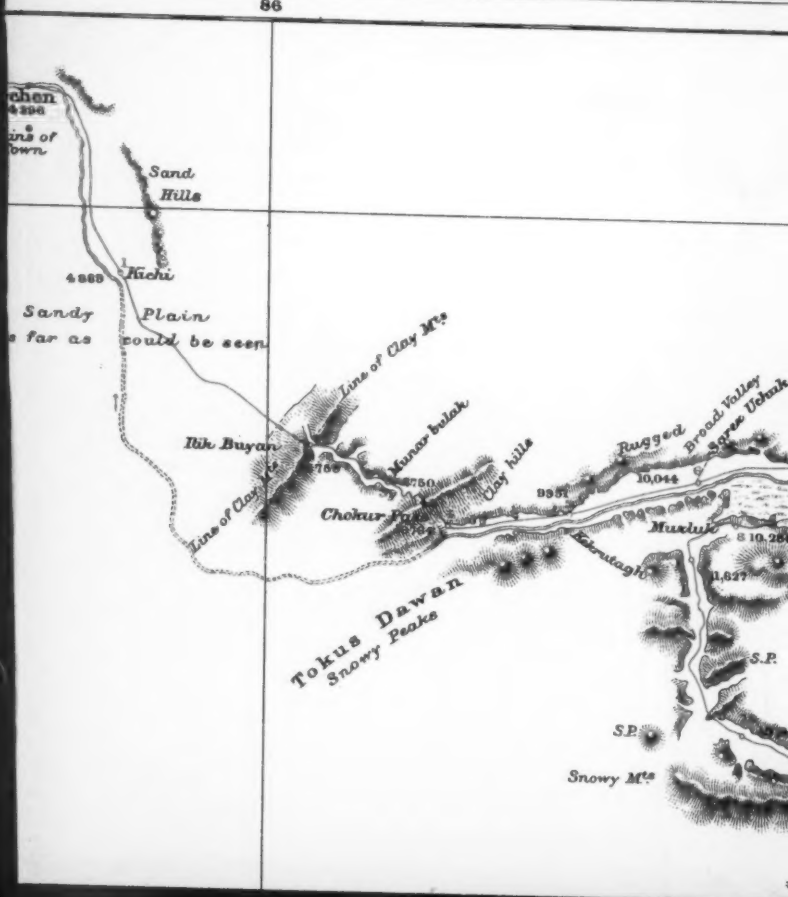
Twelve Photographs of Spitzbergen, taken during the cruise of the Training Squadron to Spitzbergen, 1895, by Mr. J. E. Corbett and Lieut. J. E. Drummond, R.N. *Presented by J. E. Corbett, Esq.*

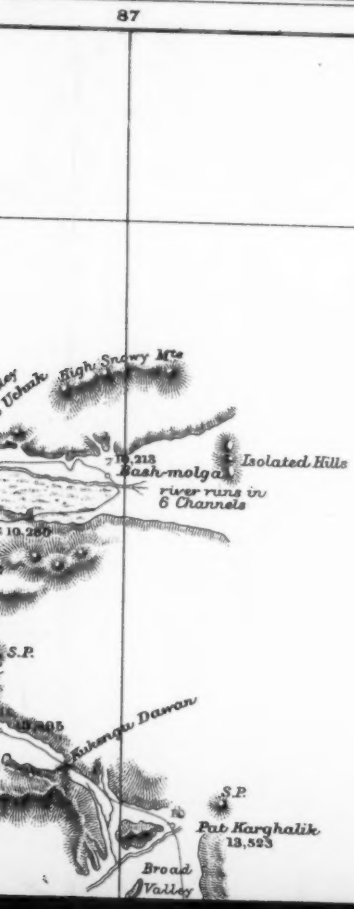
These are characteristic photographs of the Spitzbergen coast, and are well taken.

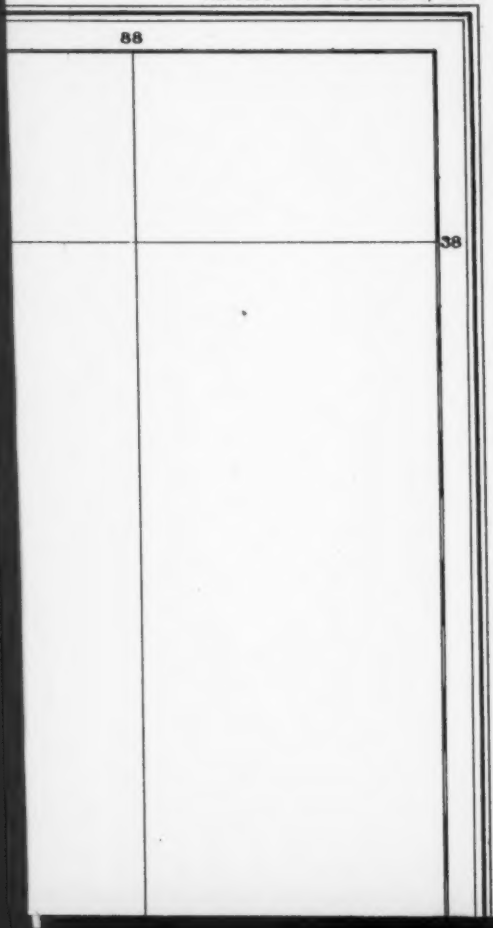
N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and address are given.

Mr Littledale's
Cherchen
4296
Remains of
old Town
38
San
as far

ndale's Map. (A.)


86
Sand Hills
Kuchi
Sandy Plain
Line of Clay Mts
Ilik Buyan
Manar bulak
Clay hills
Rugged
Broad Valley
Spurs Ushak
10,044
Chokur
Murdujk
Tokus Dawan
Snowy Peaks
S.P.
S.P.
Snowy Mts


87
88
High Snowy Mts
10,213
Bash-molgan
Isolated Hills
river runs in
6 Channels
10,285
S.P.
Kukrgan Dawan
S.P.
Pat Karghalik
13,523
Broad
Valley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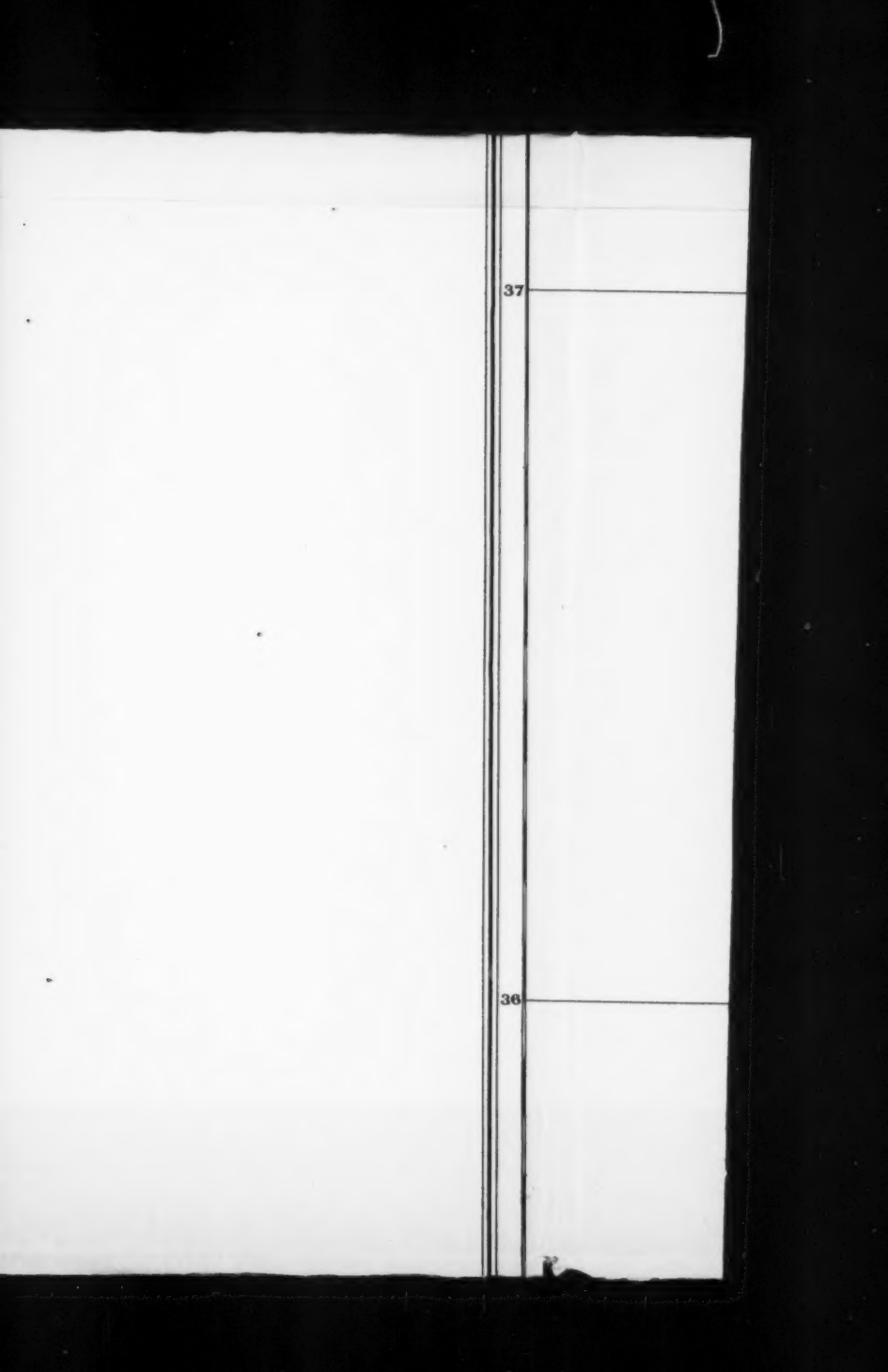
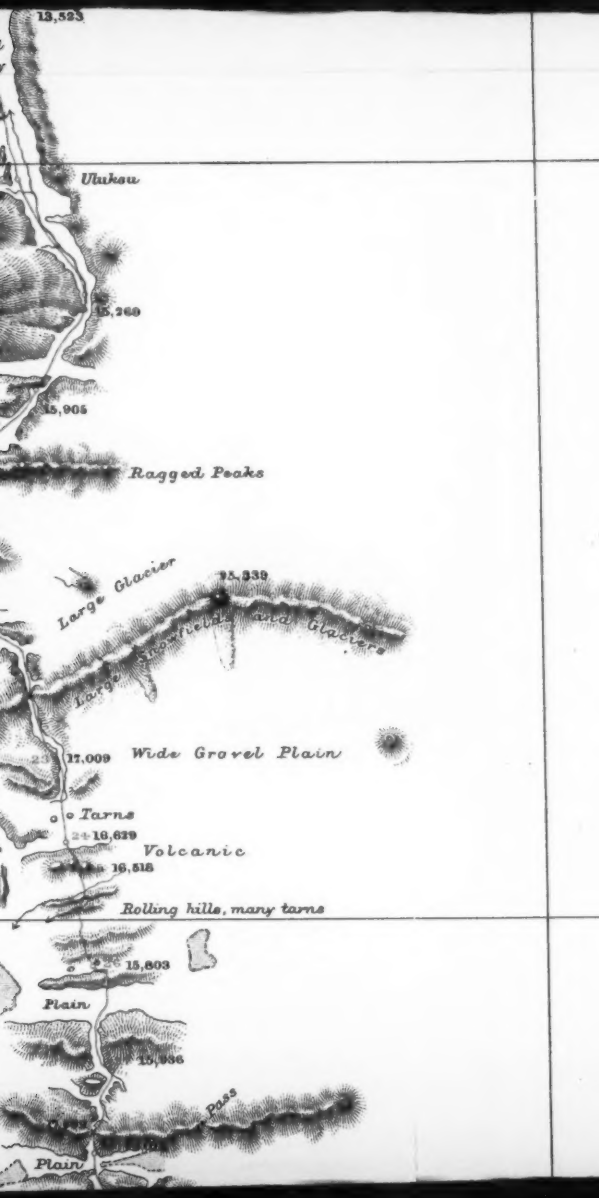
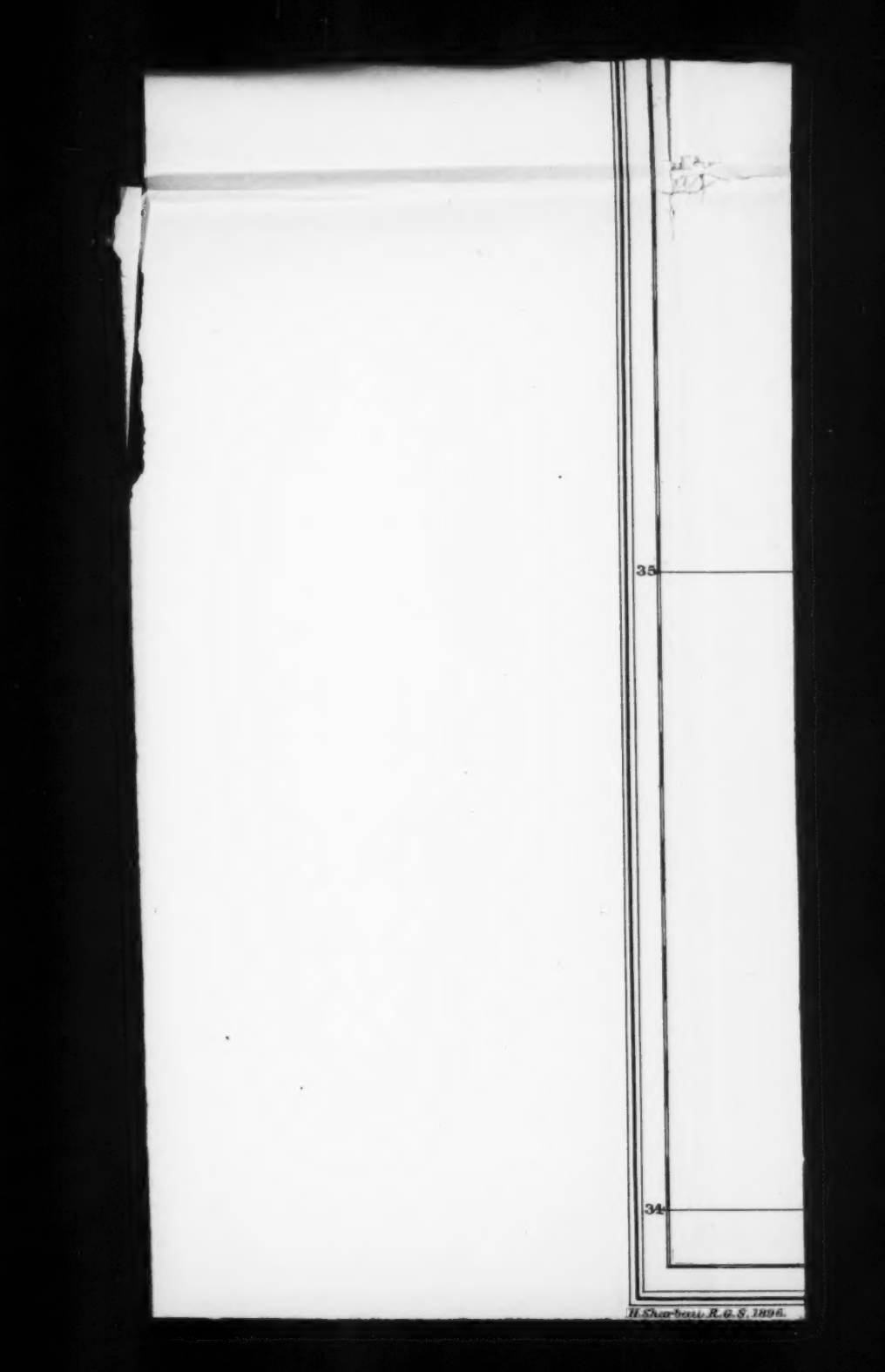

37
36

Broad Valley
Gap
High Snowy Ridge
Twin Peaks
Valley sinking rapidly
Volc.
Volc.
Volc.
Volc
Volcanic


13,523
Uluksu
15,269
15,905
Ragged Peaks
Large Glacier
25,339
Large Snowfields and Glaciers
17,009
Wide Gravel Plain
Tarns
16,629
Volcanic
16,515
Rolling hills, many tarns
15,803
Plain
15,936
Pass
Plain

37

36


35
34
H. Shearburn, R.G.S. 1896.

86

Longitude East 87 of Greenwi

1896.

Published by the Royal Geographical

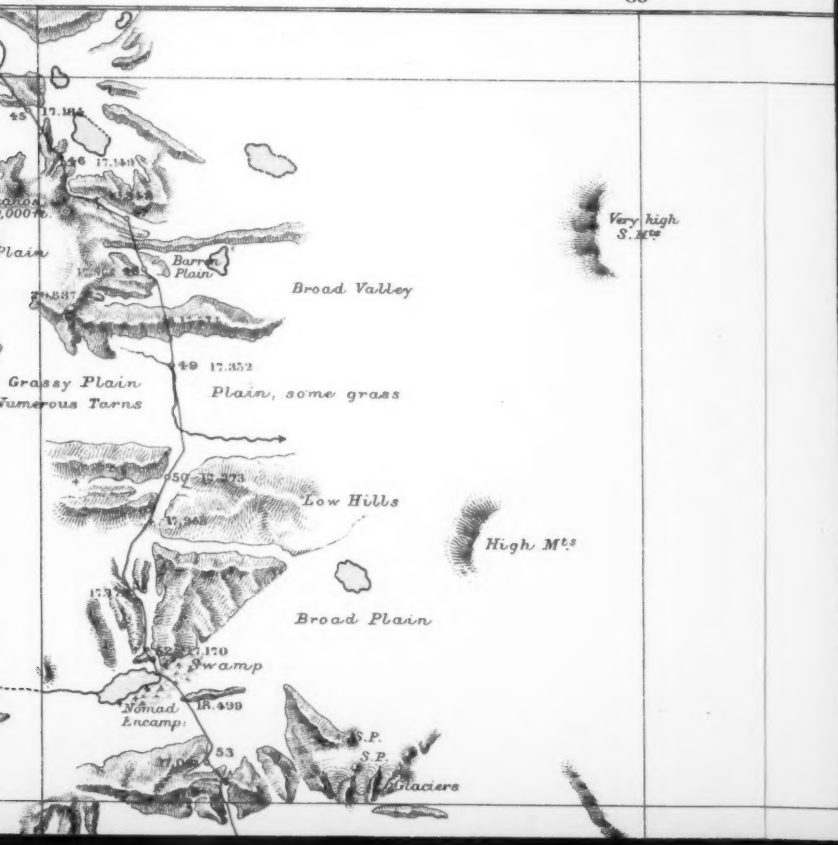
eenwich.

hical Society.

F.S.Weller F.R.G.S.

Mr Littledale's Map. (B.)

87
88
S. Mt.
Low Ridge
Broad Plain
Snowy Mountains
Low undulating ground
with occasional bluff
S.P.


88
89
Very high
S. Mts
Barren
Plain
Broad Valley
Grassy Plain
Numerous Tarns
Plain, some grass
Low Hills
High Mts
Broad Plain
Swamp
Nomad
Encamp.
S.P.
S.P.
Glaciers

91
34
33

N.
C I F I C O C E A N
Waikukupa R.

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Waiho River
kupa R.
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Frit
Mt Gaskell
Fox River

e of English Miles.

4 5 6 7 8 9 10

THE

THE SOUTHE

by

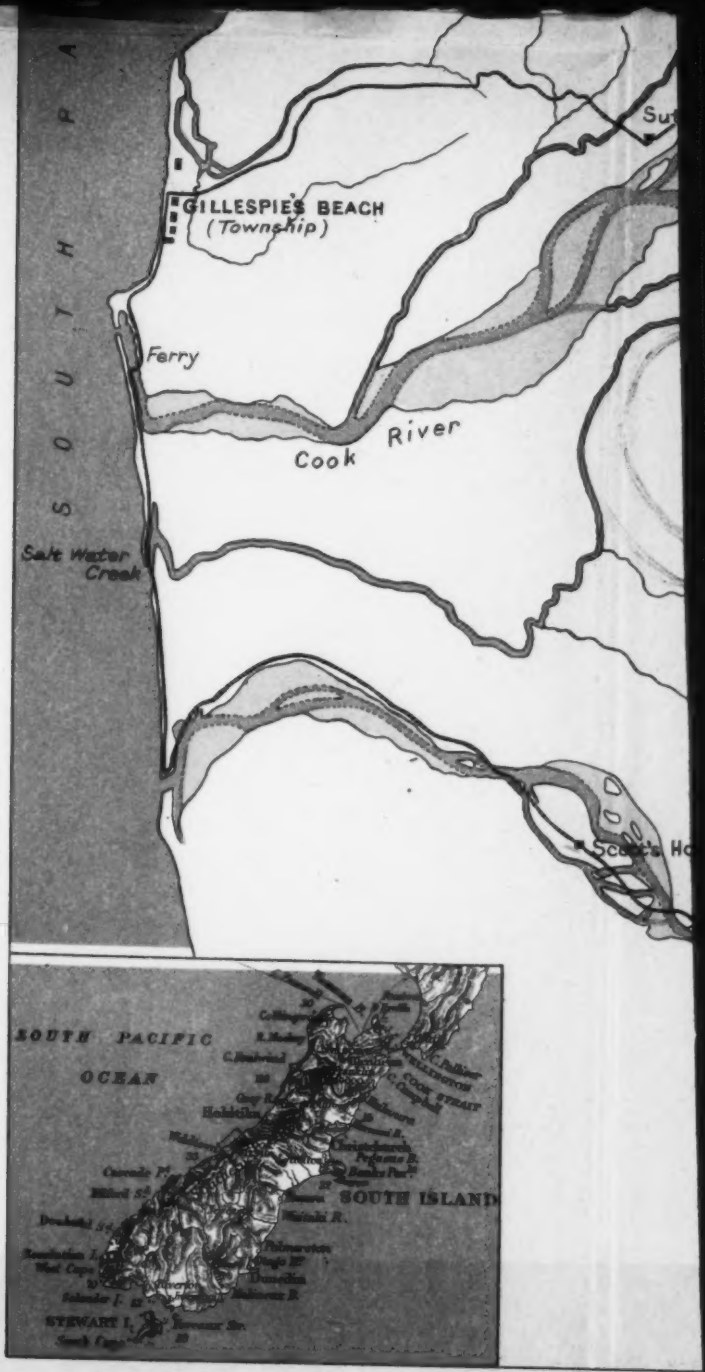
A SKETCH MAP

to illustrate

THE FIRST CROSSING OF

OUTHERN ALPS OF NEW ZEALAND

by E. A. FITZ GERALD


SOUTH PA
GILLESPIES BEACH
(Township)
Ferry
Cook River
Salt Water Creek
SOUTH PACIFIC
OCEAN
SOUTH ISLAND
STEWART I.

Published by the Royal Geograph

graphical Society.

routes shown thus ———

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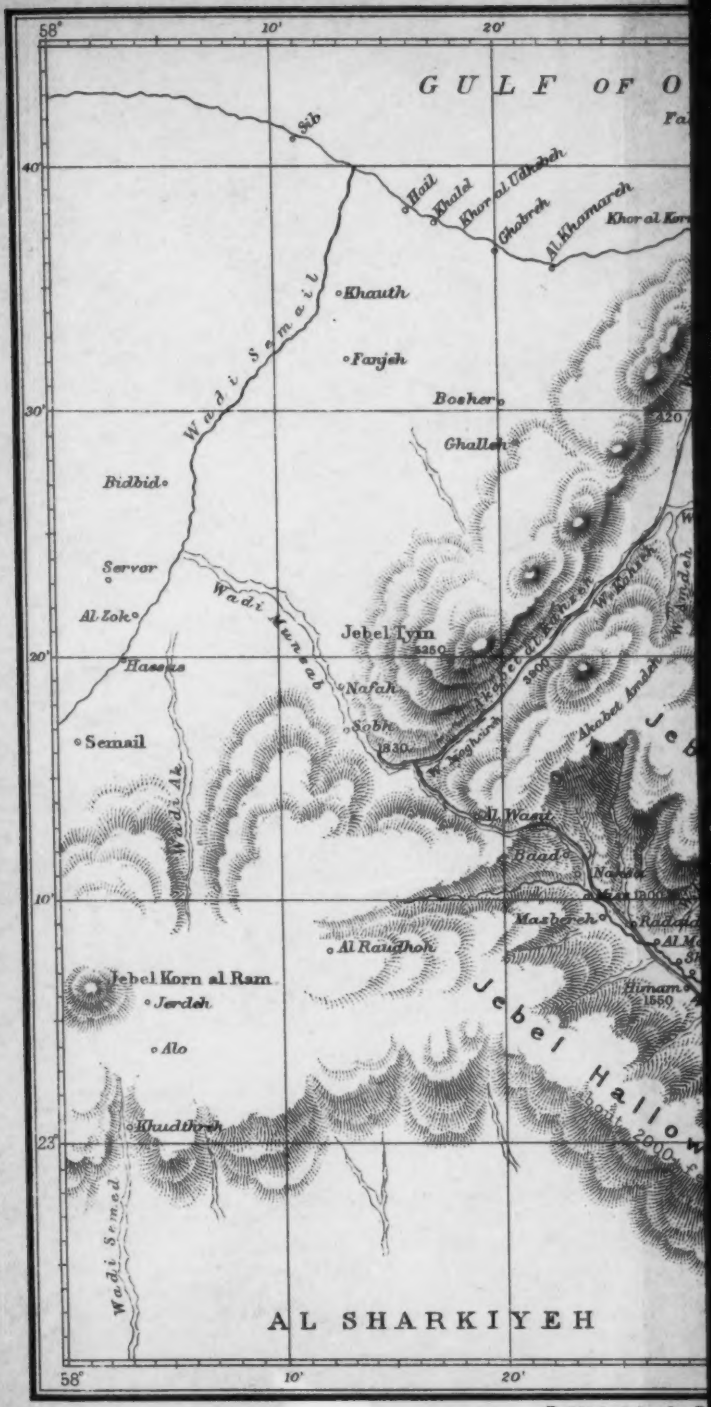
Standford's Geographical Establishment.



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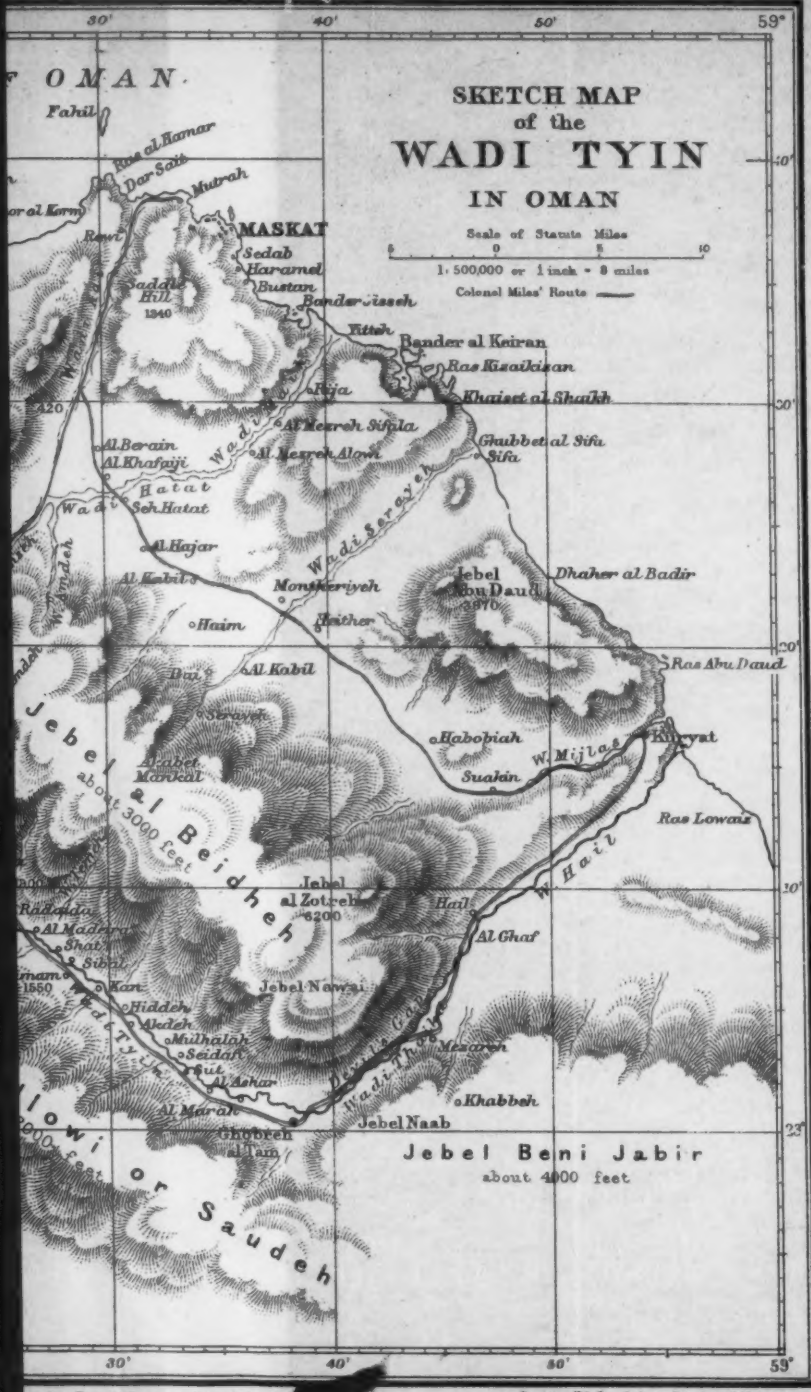


...y the Royal Geographical Society

George Philip & Son, London & Liverpool

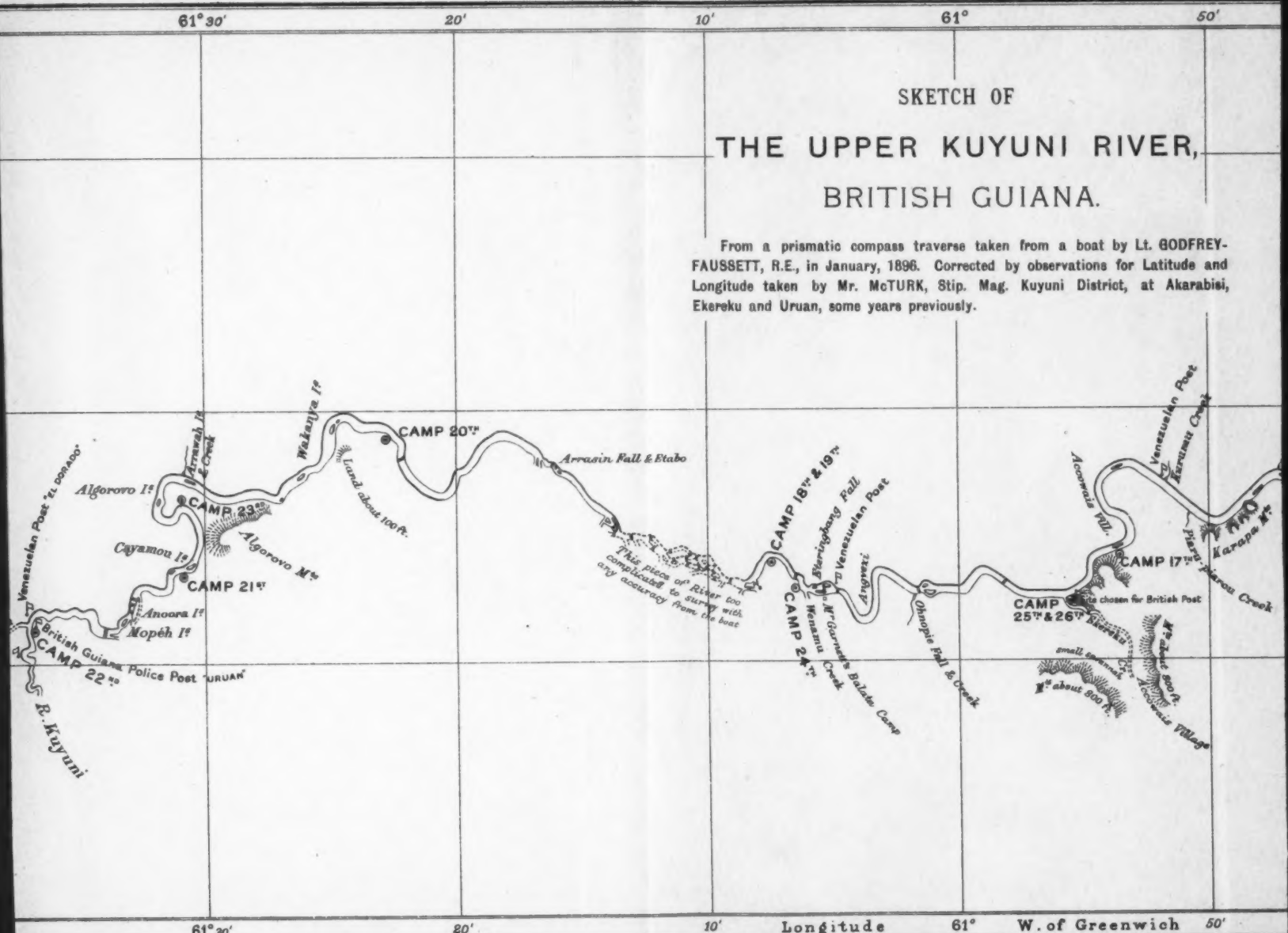
7°
50'
8°
40'
R. Uruan
Venezuelan Post
Venezuelan Post
R. Kuy

SKETCH OF

THE UPPER KUYUNI RIVER,

BRITISH GUIANA.

From a prismatic compass traverse taken from a boat by Lt. GODFREY-FAUSSETT, R.E., in January, 1896. Corrected by observations for Latitude and Longitude taken by Mr. McTURK, Stip. Mag. Kuyuni District, at Akarabisi, Ekereku and Uruan, some years previously.



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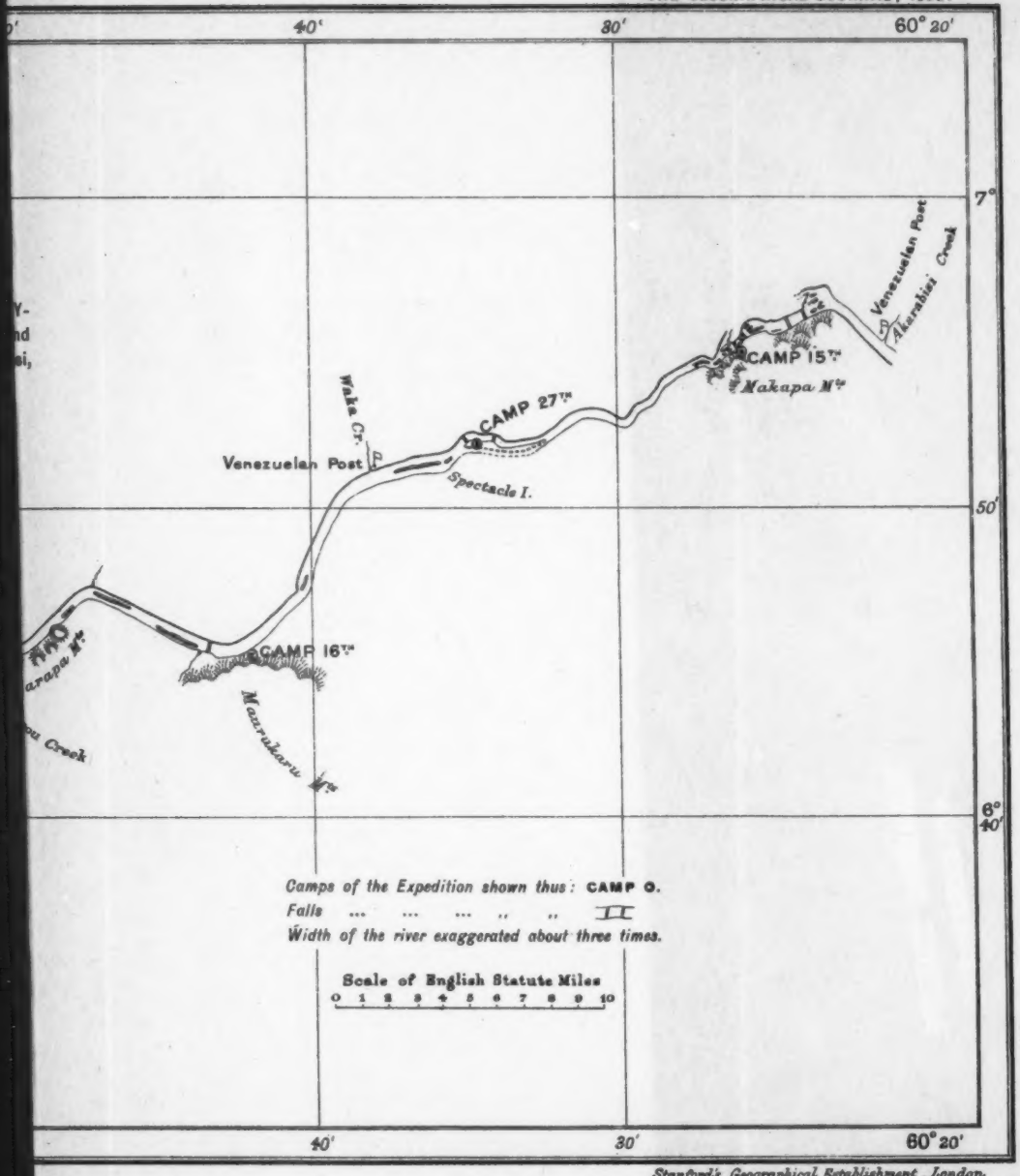

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